NATIONALGEOGRAPHIC.COM/MAGAZINE | OCTOBER 2008

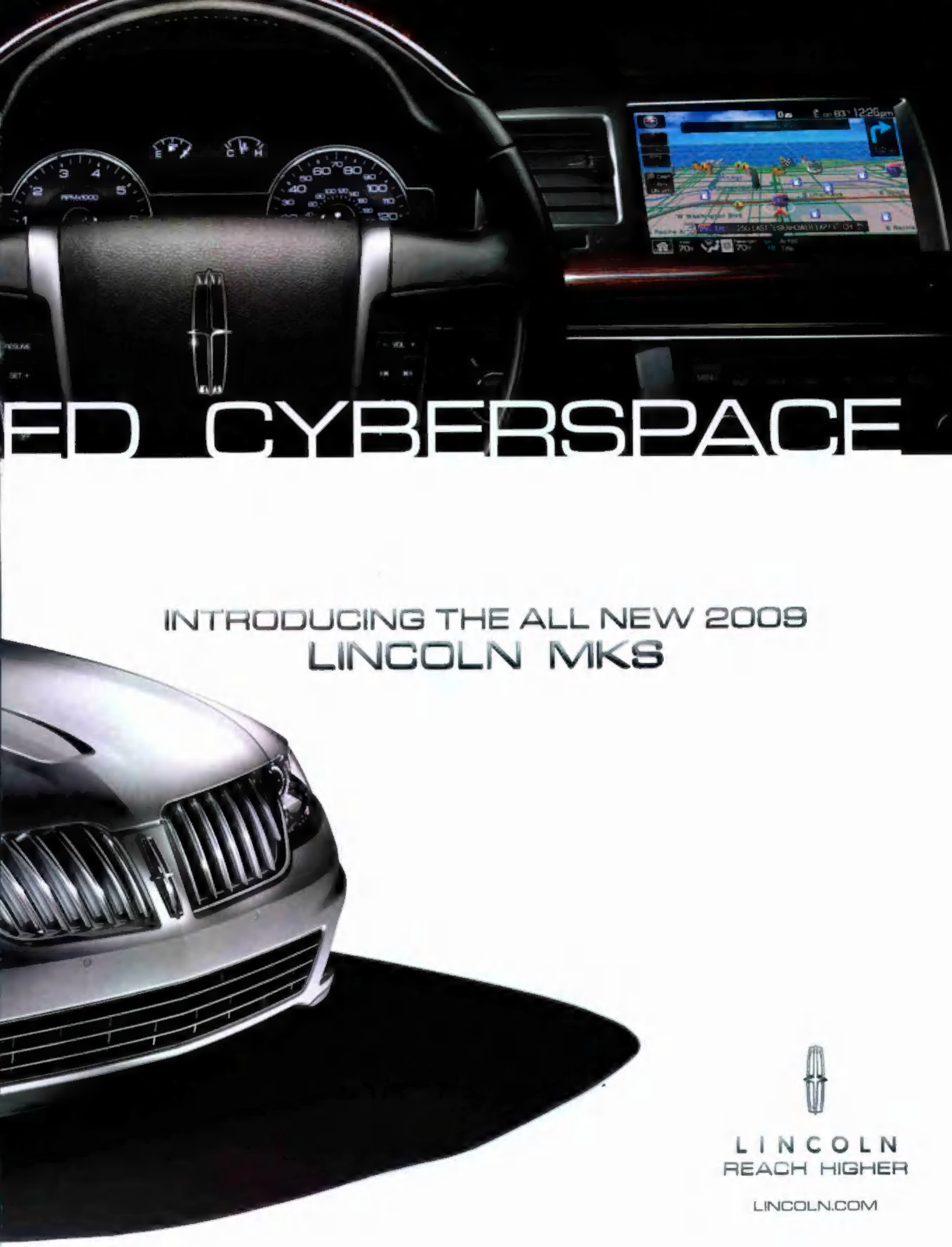
NATIONAL GEOGRAPHIC

The Other Humans

NEANDERTHALS REVEALED

LEATHER-WRAPP

Optional features shown.



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NATIONAL GEOGRAPHIC

OCTOBER 2008 · VOL. 214 · NO. 4

BRIAN SKERRY

The roughened skin over this right whale's eye is covered with tiny crustaceans called whale lice. Story on page 100.

OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY

NATIONAL GEOGRAPHIC

OCTOBER 2008

CULTURE

The Dirt on Baseball

Each major league team has a vat of "magic mud."

FOOD

Rapid Rise

A wheat shortage is pushing up bread prices.

CULTURE

You Can't Say That

Insult laws stifle freedom of the press.

CONSERVATION

Zoos, Improved

Smarter exhibit designs mean fitter animals.

CLIMATE

Color Theory

Is climate change distorting fall hues?

SCIENCE

Ratted Out

In Africa, mine-sniffing rats save lives.

On the Cover

The life-size model of a Neanderthal woman took six months to create.

Photo by Joe McNally

Reconstruction by Kennis & Kennis

ngm.com

Your Best Shots

This month, Your Shot displays a gallery of readers' images of India. In My Shot Minute videos, lightning strikes, Chairman Mao dolls wave hello, and a pig takes a swim.

BRIAN YEN

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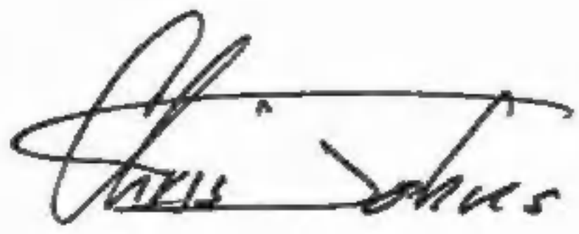
EDITOR'S NOTE

The Ozark Highlands National Recreation Trail wends through a forest in Arkansas.

My life has been bracketed by trails. I grew up near the Pacific Crest National Scenic Trail, which meanders from the Pacific Northwest rain forest to the California desert valley and passes through the Sky Lakes Wilderness in southern Oregon. It's where I first tasted the magic of two loves, a backpack and a camera. I can remember rolling out of a tent to photograph a small lake as fingers of light poked through a scrim of mist and the rising sun burnished the landscape with the intense gold of late summer.

Thirty-six years later, on the other side of the continent, I can sit on my front porch, look west to the Blue Ridge Mountains, and see that other marquee route—the Appalachian Trail. I remember the first time I hiked the Appalachian. Being a Westerner, I imagined I knew what real mountains were; I figured I was in for a cakewalk. I was wrong. The Appalachian Trail upended my arrogance. I realized that a challenging hike and incredible beauty were not exclusive to the Pacific Crest.

This year marks the 40th anniversary of the founding of a national system that incorporates 1,077 trails, totaling more than 66,000 miles in all 50 states. We feature one of them—Arkansas's Ozark Highlands Trail—in this issue. "Build a trail and they will come," says Pam Gluck, executive director of American Trails, a nonprofit that works to protect trails across the country. Trails, she points out, promote exercise and can help ease traffic congestion and decrease pollution. Most of all, trails put us in touch with nature—and ultimately ourselves.



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The National Geographic Society is chartered in Washington, D.C., as a nonprofit scientific and educational organization "for the increase and diffusion of geographic knowledge." Since 1888 the Society has supported more than 9,000 explorations and research projects, adding to knowledge of earth, sea, and sky.

Lesser Prairie-chicken *(Tympanuchus pallidicinctus)*
Size: Head and body length, 38 - 41 cm (15 - 16.2 inches); wingspan, approx. 63 cm (24.8 inches)
Weight: 580 - 820 g (1.3 - 1.8 lbs) **Habitat:** Sandy-soil prairie with dwarf shrub and mixed grass vegetation, along with some cropland **Surviving number:** Estimated at 10,000 - 20,000

Photographed by Michael Forsberg

WILDLIFE AS CANON SEES IT

Duel by duet? It's all part of the "gobbling" dominance displays among male lesser prairie-chickens during breeding season. Rivals stand several yards apart and alternate vocalizations, often followed by an up-close face-off. They also compete by raising their magnificent pinnae. When airborne predators are around, the prairie-chicken keeps a much lower profile, staying still while gazing skyward. Sensitive to threats from above, it avoids nesting or displaying within ■ half-mile of tall objects that could serve as perches for predators. This is a serious complication, as its habitat is already fragmented—open space is a rare commodity.

As an active, committed global corporation, we join worldwide efforts to promote awareness of endangered species. Just one way we are working to make the world ■ better place—today and tomorrow. Visit **ngm.com/canonwildlife** to find out more.

LETTERS

June 2008

Secrets of Stonehenge

I have climbed the ruins of Cobá's great pyramid and surveyed Teotihuacan from atop the Pyramid of the Sun, and I have seen up close several of Europe's and America's acclaimed cathedrals. But none can compare, in my eyes, to the grandeur of Stonehenge sitting in the midst of the Salisbury Plain when first viewed from the highway coming out of London. Afar and nearby, Stonehenge is breathtaking and awe inspiring in a way that only natural wonders can approach, not the least because this structure represents an unprecedented use of intellectual, economic, and physical wherewithal by a minimal, out-of-the-way population. The essence of humanity—our strivings and aspirations, perhaps even our fears—lies manifest in those stones.

CHRISTOPHER C. TEW
Greensboro, North Carolina

I believe that anybody involved in heavy construction before the 20th century would have recognized Stonehenge's "avenue" as an ice road. Before the advent of heavy trucks, it was common practice when something really heavy had to be moved. Workers prepared a level, banked road or even a canal, built a sled under the item to be moved, waited for cold weather, flooded the road and let it freeze, and dragged the sled on the ice. It was a lot of preparation and waiting, but well worth it when you consider the lack of options.

JACK ARMSTRONG
West Chester, Pennsylvania

It's unlikely that the Stonehenge avenue could have been used as an ice road, since the rolling terrain between Stonehenge and the river would prevent any water flooding the area from freezing flat.

In my mind's eye, I see Stonehenge as a roofed structure with beams resting between the lower, outer sarsens and the taller ones within, creating a flattened conical roof. The inner sarsen horseshoe shape would leave an open skylight facing the avenue that marks the pathway of the rising sun of the summer solstice. I can imagine a beam of light cast through this opening into the darkness of the enclosed area to strike some sacred image at the first light of summer.

JOHN E. RIESKE
Ostrander, Ohio

It has always troubled me how little, if any, attention is given to the possibility that Stonehenge might be a sports complex. Throughout history man has dedicated time and resources to at least three types of construction. Man will build edifices for the purposes of religion. He will build defensive structures. But he will also put his efforts into sports arenas: witness the Colosseum in Rome, the various hippodromes, the Maya ball courts, and today's monstrous stadiums and ball parks. There are stone circles throughout Britain and elsewhere in Europe. Could it be possible that these are the local arenas for whatever game might have been played at Stonehenge? Could Stonehenge be the site of a prehistoric World Series, and the dozens of other prehistoric stone circles the arenas of local teams in a prehistoric bush league?

P. O. ABBOTT
Pueblo, Colorado

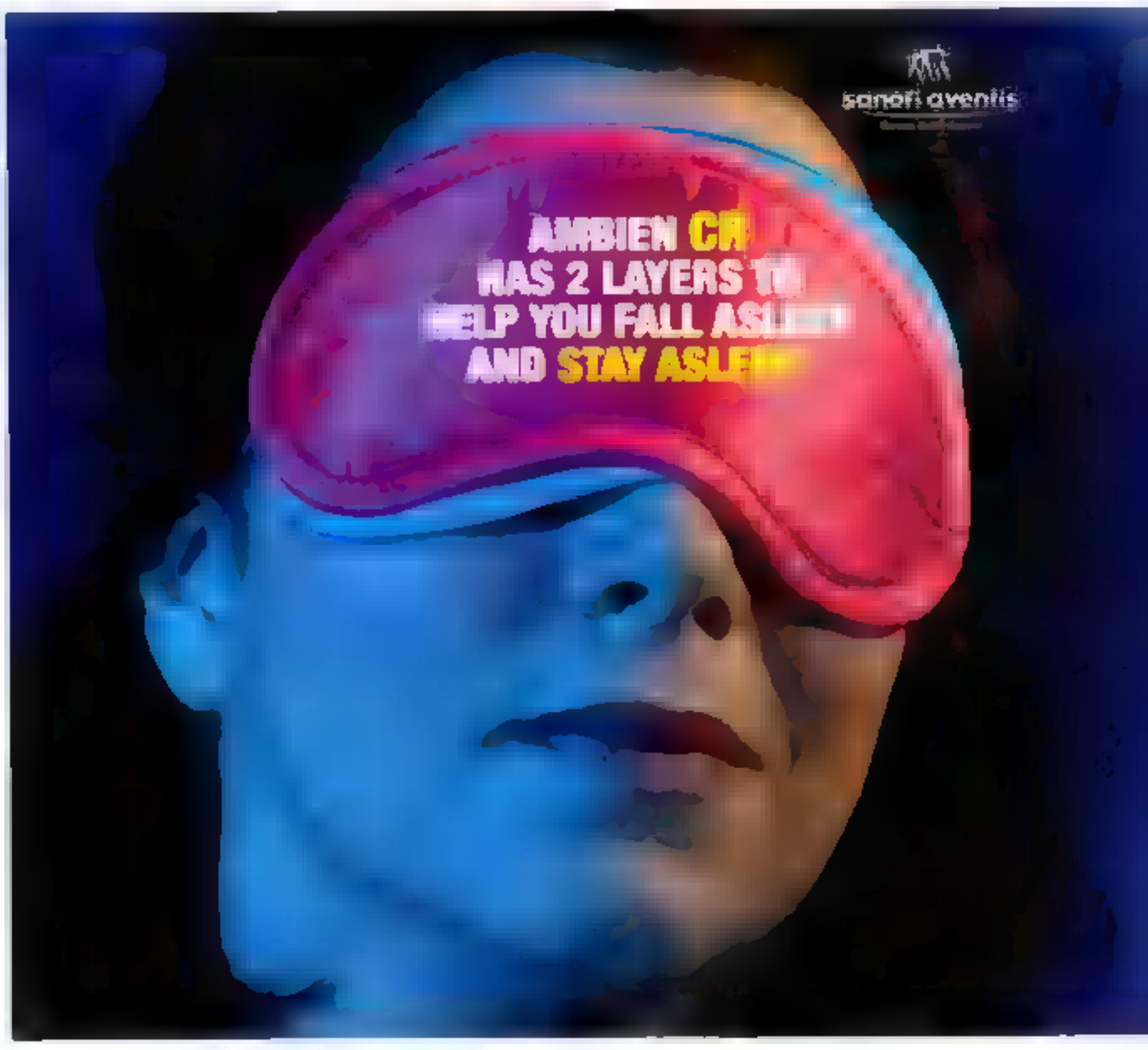
My wife and I have bicycled to Stonehenge twice. Seeing it as you cycle up over the surrounding hills is, to me, the most impressive view. The morning light hitting it makes Stonehenge seem to float above the plain. But I wanted to share an epiphany I had the last time we visited. We were camping just east of Avebury and its large series of standing stones. The idea stems from my respect for evolutionary psychology and my observation of human behavior—including my own. Stonehenge, if understood more obliquely, was ultimately built to impress the girls.

GIL McFARLANE
Ventura, California

Contact Us

Email ngsforum@ngm.com
Write National Geographic Magazine, PO Box 98199, Washington, DC 20090-8199.
Include name, address, and daytime telephone. Letters may be edited for clarity and length.

DID YOU KNOW THERE ARE 2 FORMS OF AMBIEN (ZOLPIDEM TARTRATE)C? AND THERE IS AN IMPORTANT DIFFERENCE.



AMBIEN CR is the only form of Ambien that is FDA approved to help you fall asleep and stay asleep:

The first layer dissolves quickly to help you fall asleep fast, while the second dissolves slowly to help you stay asleep.* So you wake up less frequently and fall back to sleep faster.

For people who have trouble falling asleep and/or staying asleep, only AMBIEN CR has two layers that address both problems: The first layer dissolves quickly to help you fall asleep fast, while the second dissolves slowly to help you stay asleep, so you can wake up ready for your day.** AMBIEN CR can be taken for as long as your healthcare provider recommends. **Ask your prescriber if AMBIEN CR is right for you.**

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* Proven effective for up to 7 hours in clinical studies

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AMBIEN CR is indicated to help you fall asleep and/or stay asleep.

IMPORTANT SAFETY INFORMATION

AMBIEN CR is a treatment option you and your doctor can consider along with lifestyle changes and can be taken for as long as your doctor recommends. Until you know how AMBIEN CR will affect you, you shouldn't drive or operate machinery. Be sure you're able to devote 7 to 8 hours to sleep before being active again. Sleepwalking, and eating or driving while not fully awake, with amnesia for the event have been reported. If you experience any of these behaviors contact your provider immediately. In rare cases sleep aids may cause allergic reactions such as swelling of your tongue or throat or shortness of breath. If you have an allergic reaction while using AMBIEN CR, contact your doctor immediately. Side effects may include next-day drowsiness, dizziness and headache. It's non-narcotic; however, like most sleep medicines it has some risk of dependency. Don't take it with alcohol.

AMBIEN is indicated for short-term treatment to help you fall asleep.

IMPORTANT SAFETY INFORMATION

When you first start taking AMBIEN, use caution in the morning when engaging in activities requiring complete alertness until you know how you will react to this medication. In most instances, memory problems can be avoided if you take AMBIEN only when you are able to get a full night's sleep (7 to 8 hours) before you need to be active again. As with any sleep medication, do not use alcohol while you are taking AMBIEN. Sleepwalking, and eating or driving while not fully awake, with amnesia for the event, have been reported. If you experience any of these behaviors contact your provider immediately. In rare cases, sleep medicines may cause allergic reactions such as swelling of your tongue or throat, shortness of breath or more severe results. If you have an allergic reaction while using AMBIEN, contact your doctor immediately. Prescription sleep aids are often taken for 7 to 10 days – or longer as advised by your provider. Like most sleep medicines, it has some risk of dependency. There is a low occurrence of side effects associated with the short-term use of AMBIEN. The most commonly observed side effects in controlled clinical trials were drowsiness (2%), dizziness (1%), and diarrhea (1%).

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or 1-800-FDA-1088

AMBIEN CR
ZOLPIDEM TARTRATE EXTENDED-RELEASE TABLETS C IV
6.25-MG & 12.5-MG EXTENDED RELEASE TABLETS
A GOOD NIGHT'S SLEEP FROM START TO FINISH

Please see important medication guide on adjoining page.

MEDICATION GUIDE

AMBIEN CR® (ām'bē-ən see ahr) **C-IV**

(*zolpidem tartrate extended-release tablets*)

Read the Medication Guide that comes with AMBIEN CR before you start taking it and each time you get a refill. There may be new information. This Medication Guide does not take the place of talking to your doctor about your medical condition or treatment.

What is the most important information I should know about AMBIEN CR?

After taking AMBIEN CR, you may get up out of bed while not being fully awake and do an activity that you do not know you are doing. The next morning, you may not remember that you did anything during the night. You have a higher chance for doing these activities if you drink alcohol or take other medicines that make you sleepy with AMBIEN CR. Reported activities include:

- driving a car ("sleep-driving")
- making and eating food
- talking on the phone
- having sex
- sleep-walking

Call your doctor right away if you find out that you have done any of the above activities after taking AMBIEN CR.

Important:

1. Take AMBIEN CR exactly as prescribed

- Do not take more AMBIEN CR than prescribed.
- Take AMBIEN CR right before you get in bed, not sooner.

2. Do not take AMBIEN CR if you:

- drink alcohol
- take other medicines that can make you sleepy. Talk to your doctor about all of your medicines. Your doctor will tell you if you can take AMBIEN CR with your other medicines.
- cannot get a full night's sleep

What is AMBIEN CR?

AMBIEN CR is a sedative-hypnotic (sleep) medicine. AMBIEN CR is used in adults for the treatment of a sleep problem called insomnia. Symptoms of insomnia include:

- trouble falling asleep
- waking up often during the night

AMBIEN CR is not for children.

AMBIEN CR is a federally controlled substance (C-IV) because it can be abused or lead to dependence. Keep AMBIEN CR in a safe place to prevent misuse and abuse. Selling or giving away AMBIEN CR may harm others, and is against the law. Tell your doctor if you have ever abused or have been dependent on alcohol, prescription medicines or street drugs.

Who should not take AMBIEN CR?

Do not take AMBIEN CR if you are allergic to anything in it. See the end of this Medication Guide for a complete list of ingredients in AMBIEN CR.

AMBIEN CR may not be right for you. Before starting AMBIEN CR, tell your doctor about all of your health conditions, including if you:

- have a history of depression, mental illness, or suicidal thoughts
- have a history of drug or alcohol abuse or addiction
- have kidney or liver disease
- have a lung disease or breathing problems
- are pregnant, planning to become pregnant, or breastfeeding

Tell your doctor about all of the medicines you take including prescription and nonprescription medicines, vitamins and herbal supplements. Medicines can interact with each other, sometimes causing serious side effects. **Do not take AMBIEN CR with other medicines that can make you sleepy.**

Know the medicines you take. Keep a list of your medicines with you to show your doctor and pharmacist each time you get a new medicine.

How should I take AMBIEN CR?

- Take AMBIEN CR exactly as prescribed. Do not take more AMBIEN CR than prescribed for you.
- **Take AMBIEN CR right before you get into bed.**
- **Do not take AMBIEN CR unless you are able to stay in bed a full night (7-8 hours) before you must be active again.**
- Swallow AMBIEN CR Tablets whole. Do not chew or break the tablets. Tell your doctor if you cannot swallow tablets whole.
- For faster sleep onset, AMBIEN CR should NOT be taken with or immediately after a meal.
- Call your doctor if your insomnia worsens or is not better within 7 to 10 days. This may mean that there is another condition causing your sleep problems.
- If you take too much AMBIEN CR or overdose, call your doctor or poison control center right away, or get emergency treatment.

What are the possible side effects of AMBIEN CR?

Serious side effects of AMBIEN CR include:

- **getting out of bed while not being fully awake and do an activity that you do not know you are doing.** (See "What is the most important information I should know about AMBIEN CR?)
- **abnormal thoughts and behavior.** Symptoms include more outgoing or aggressive behavior than normal, confusion, agitation, hallucinations, worsening of depression, and suicidal thoughts or actions.
- **memory loss**
- **anxiety**
- **severe allergic reactions.** Symptoms include swelling of the tongue or throat, trouble breathing, and nausea and vomiting. Get emergency medical help if you get these symptoms after taking AMBIEN CR.

Call your doctor right away if you have any of the above side effects or any other side effects that worry you while using AMBIEN CR.

The most common side effects of AMBIEN CR are:

- headache
- sleepiness
- dizziness
- You may still feel drowsy the next day after taking AMBIEN CR. **Do not drive or do other dangerous activities after taking AMBIEN CR until you feel fully awake.**

After you stop taking a sleep medicine, you may have symptoms for 1 to 2 days such as: trouble sleeping, nausea, flushing, lightheadedness, uncontrolled crying, vomiting, stomach cramps, panic attack, nervousness, and stomach area pain.

These are not all the side effects of AMBIEN CR. Ask your doctor or pharmacist for more information.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1–800–FDA–1088.

How should I store AMBIEN CR?

- Store AMBIEN CR at room temperature, 59° to 77°F (15° to 25° C).
- **Keep AMBIEN CR and all medicines out of reach of children.**

General Information about AMBIEN CR

- Medicines are sometimes prescribed for purposes other than those listed in a Medication Guide.
- Do not use AMBIEN CR for a condition for which it was not prescribed.
- Do not share AMBIEN CR with other people, even if you think they have the same symptoms that you have. It may harm them and it is against the law.

This Medication Guide summarizes the most important information about AMBIEN CR. If you would like more information, talk with your doctor. You can ask your doctor or pharmacist for information about AMBIEN CR that is written for healthcare professionals. For more information about AMBIEN CR, call 1-800-633-1610 or visit www.ambiencr.com.

What are the ingredients in AMBIEN CR?

Active Ingredient: Zolpidem tartrate

Inactive Ingredients: The 6.25 mg tablets contain: colloidal silicon dioxide, hypromellose, lactose monohydrate, magnesium stearate, microcrystalline cellulose, polyethylene glycol, potassium bitartrate, red ferric oxide, sodium starch glycolate, and titanium dioxide. The 12.5 mg tablets contain: colloidal silicon dioxide, FD&C Blue #2, hypromellose, lactose monohydrate, magnesium stearate, microcrystalline cellulose, polyethylene glycol, potassium bitartrate, sodium starch glycolate, titanium dioxide, and yellow ferric oxide.

Rx Only

This Medication Guide has been approved by the U.S. Food and Drug Administration.

sanofi-aventis U.S. LLC
Bridgewater, NJ 08807

January 2008a
AMBCR-JAN08a-M-Ab

MEDICATION GUIDE
AMBIEN® (ām'bē-ən) Tablets C-IV
(zolpidem tartrate)

Read the Medication Guide that comes with AMBIEN before you start taking it and each time you get a refill. There may be new information. This Medication Guide does not take the place of talking to your doctor about your medical condition or treatment.

What is the most important information I should know about AMBIEN?

After taking AMBIEN, you may get up out of bed while not being fully awake and do an activity that you do not know you are doing. The next morning, you may not remember that you did anything during the night. You have a higher chance for doing these activities if you drink alcohol or take other medicines that make you sleepy with AMBIEN. Reported activities include:

- driving a car ("sleep-driving")
- making and eating food
- talking on the phone
- having sex
- sleep-walking

Call your doctor right away if you find out that you have done any of the above activities after taking AMBIEN.

Important:

1. Take AMBIEN exactly as prescribed

- Do not take more AMBIEN than prescribed.
- Take AMBIEN right before you get in bed, not sooner.

2. Do not take AMBIEN if you:

- drink alcohol
- take other medicines that can make you sleepy. Talk to your doctor about all of your medicines. Your doctor will tell you if you can take AMBIEN with your other medicines.
- cannot get a full night's sleep

What is AMBIEN?

AMBIEN is a sedative-hypnotic (sleep) medicine. AMBIEN is used in adults for the short-term treatment of a sleep problem called insomnia. Symptoms of insomnia include:

- trouble falling asleep

AMBIEN is not for children.

AMBIEN is a federally controlled substance (C-IV) because it can be abused or lead to dependence. Keep AMBIEN in a safe place to prevent misuse and abuse. Selling or giving away AMBIEN may harm others, and is against the law. Tell your doctor if you have ever abused or have been dependent on alcohol, prescription medicines or street drugs.

Who should not take AMBIEN?

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See the end of this Medication Guide for a complete list of ingredients in AMBIEN.

AMBIEN may not be right for you. Before starting AMBIEN, tell your doctor about all of your health conditions, including if you:

- have a history of depression, mental illness, or suicidal thoughts
- have a history of drug or alcohol abuse or addiction
- have kidney or liver disease
- have a lung disease or breathing problems
- are pregnant, planning to become pregnant, or breastfeeding

Tell your doctor about all of the medicines you take including prescription and nonprescription medicines, vitamins and herbal supplements. Medicines can interact with each other, sometimes causing serious side effects. **Do not take AMBIEN with other medicines that can make you sleepy.**

Know the medicines you take. Keep a list of your medicines with you to show your doctor and pharmacist each time you get a new medicine.

How should I take AMBIEN?

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- **Do not take AMBIEN unless you are able to stay in bed a full night (7-8 hours) before you must be active again.**
- For faster sleep onset, AMBIEN should NOT be taken with or immediately after a meal.
- Call your doctor if your insomnia worsens or is not better within 7 to 10 days. This may mean that there is another condition causing your sleep problem.
- If you take too much AMBIEN or overdose, call your doctor or poison control center right away, or get emergency treatment.

What are the possible side effects of AMBIEN?
Serious side effects of AMBIEN include:

- **getting out of bed while not being fully awake and do an activity that you do not know you are doing.** (See "What is the most important information I should know about AMBIEN?)
- **abnormal thoughts and behavior.** Symptoms include more outgoing or aggressive behavior than normal, confusion, agitation, hallucinations, worsening of depression, and suicidal thoughts or actions.
- **memory loss**
- **anxiety**
- **severe allergic reactions.** Symptoms include swelling of the tongue or throat, trouble breathing, and nausea and vomiting. Get emergency medical help if you get these symptoms after taking AMBIEN.

Call your doctor right away if you have any of the above side effects or any other side effects that worry you while using AMBIEN.

The most common side effects of AMBIEN are:

- drowsiness
- dizziness
- diarrhea
- "drugged feelings"
- You may still feel drowsy the next day after taking AMBIEN. **Do not drive or do other dangerous activities after taking AMBIEN until you feel fully awake.**

After you stop taking a sleep medicine, you may have symptoms for 1 to 2 days such as: trouble sleeping, nausea, flushing, lightheadedness, uncontrolled crying, vomiting, stomach cramps, panic attack, nervousness, and stomach area pain.

These are not all the side effects of AMBIEN. Ask your doctor or pharmacist for more information.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1–800–FDA–1088.

How should I store AMBIEN?

- Store AMBIEN at room temperature, 68° to 77°F (20° to 25°C).
- **Keep AMBIEN and all medicines out of reach of children.**

General Information about AMBIEN

- Medicines are sometimes prescribed for purposes other than those listed in a Medication Guide.
- Do not use AMBIEN for a condition for which it was not prescribed.
- Do not share AMBIEN with other people, even if you think they have the same symptoms that you have. It may harm them and it is against the law.

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What are the ingredients in AMBIEN?

Active Ingredient: Zolpidem tartrate

Inactive Ingredients: hydroxypropyl methylcellulose, lactose, magnesium stearate, micro-crystalline cellulose, polyethylene glycol, sodium starch glycolate, and titanium dioxide. In addition, the 5 mg tablet contains FD&C Red No. 40, iron oxide colorant, and polysorbate 80.

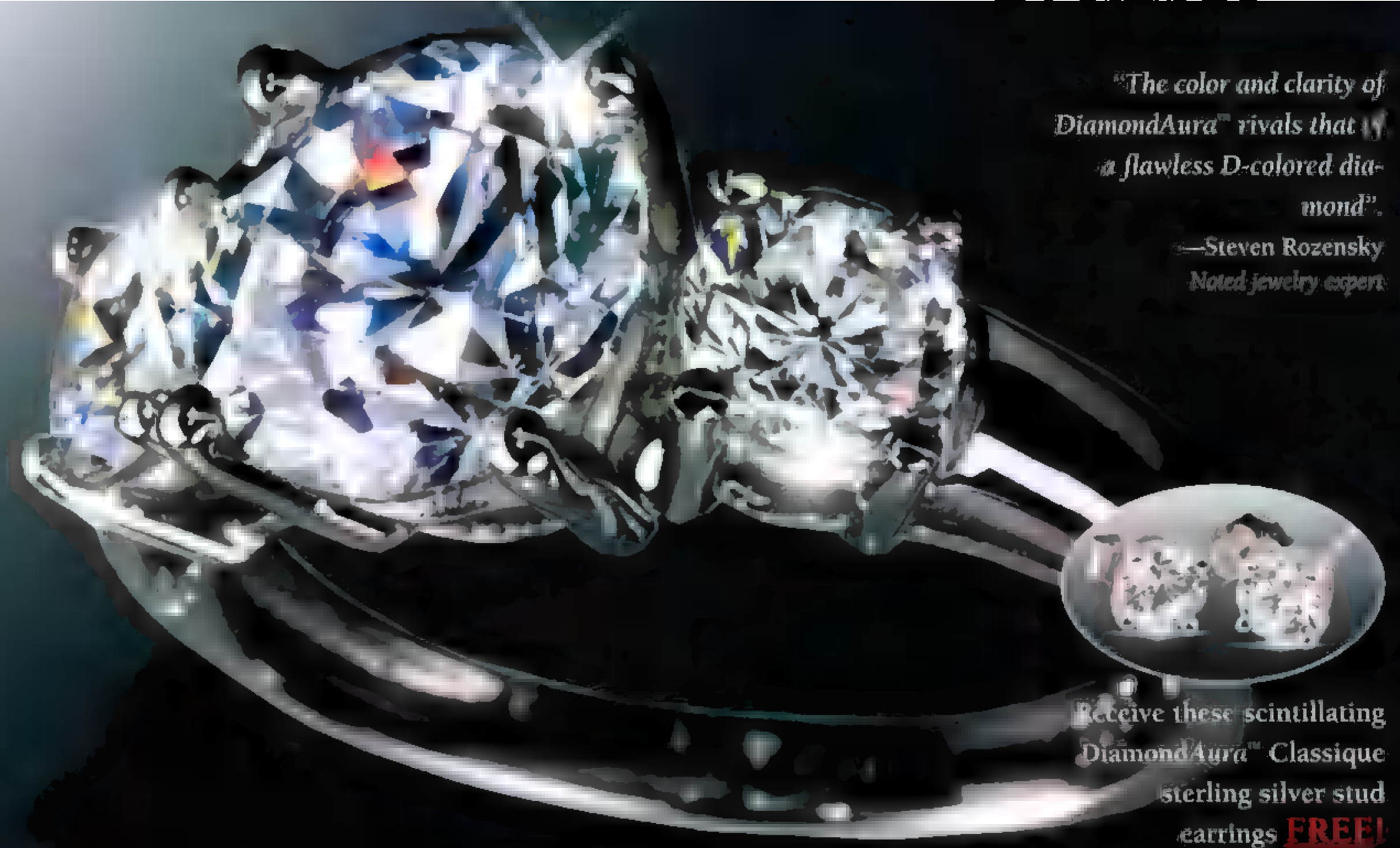
Rx Only

This Medication Guide has been approved by the U.S. Food and Drug Administration.

sanofi-aventis U.S. LLC
Bridgewater, NJ 08807

June 2008

AMB-JUNE08-F-Ac



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LETTERS

World Oil

Paul Roberts's article does not address the space between the world-oil-production forecast curve of the U.S. Department of Energy and the world-oil-production output curves. Sometime in the next ten years the world will require more oil than is available. Dreamers envision hydrogen-powered and electric cars. However, these will make up only ■ fraction of the difference. Unless the world, and especially the United States, decides to conserve energy, a catastrophe is in the making. Countries with oil will protect their interests, and the others will have to fight (perhaps literally) for the rest of the production. We must immediately start to use less fuel. Drive-in lines at banks and restaurants should be outlawed. Left turn on green when clear should be standard. Large cities should have more bus and subway routes. There are any number of ways to reduce our fuel consumption. Many will cause companies to sell less, and this will hurt their bottom lines. However, if not done, the catastrophe will occur.

ALBERT BERST
Birmingham, Alabama

I think you left out one important point regarding OPEC's reserves. You state that OPEC controls 75 percent of the world's oil reserves, which is true according to the raw numbers. However, since the 1980s, OPEC member states have had great incentive to overstate their reserves, since each nation's allowable production level is based on a percentage of their proven reserves. The more reserves they claim, the more oil they can produce, which translates to higher short-term revenue. When the quotas were instated, levels of "proven" reserves began to drift upward. OPEC's peak may come sooner than expected.

JOHN CORTINES
College Station, Texas

Sometime in the next ten years the world will require more oil than is available. Dreamers envision hydrogen-powered and electric cars. However, these will make up only ■ fraction of the difference.

We should immediately allow unlimited drilling on all federal land not in a national park or monument and all offshore areas, including the Pacific, the Gulf of Mexico, and the Atlantic. The law of supply and demand is still working. We can work our way out of the mess by increasing our supply. We cannot conserve our way to a surplus; we can only lower our standard of living, our health, and our security by using less.

JOHN P. HAMMETT
Midland, Texas

Why should we even care anymore about world oil reserves? Extracting, refining, and combusting them all would lead us even further into environmental peril. Alarming changes in our climate have already provided ample evidence that hydrocarbon combustion is essentially obsolete technology. We didn't leave the Stone Age because we ran out of stones. Likewise, we must leave the oil age before we run out of oil.

TOM DEMARCO
Whistler, British Columbia

Someday this world will run out of oil, and I fear that our kids and grandchildren are going to hate us for misusing this resource so blatantly. Each and every one of us is responsible.

RANDALL HOJNACKI
Muskego, Wisconsin

Some familiarity is found when comparing oil and toothpaste. I need toothpaste daily. The tube in my cupboard once held a large amount, easily obtained. I squeezed and watched with pleasure as the paste poured out. Lately, however, it has been more difficult. I know it is there, but it's harder to find and is discovered only with significant effort. Recognition of my depleting reserves occurred some time ago, but my concern has been buffered, for each day the paste ultimately arrives. Even now, when the tube is flat and worn, I know that extreme pressure near the nozzle will produce "white gold." Sadly, such effort produces false hope, for experience reminds me that one day even that will stop. My supply will run dry.

JASON DEVRIES
Lindstrom, Minnesota

LETTERS

Snow Leopards

In 2006 I spent five weeks in Ladakh's Zanskar Valley on a medical expedition. A highlight was working in a makeshift clinic and sleeping at Phuktal Monastery (pages 126-27). As night fell, I stared into the darkness from the main balcony and wondered about what could be looking back at me. During this time, I was told tales about snow leopards that bordered on the mythical. There is still little knowledge about these animals among the local population, but this is changing. I heard three stories about snow leopards that had fallen (or jumped) into pens or buildings through ventilation holes. Two, fortunately, ended with the animals being released into the Hemis High Altitude National Park. Establishment of the park and programs that encourage the use of metal fencing means that the farmers and the snow leopards don't end up in such situations so often. It's a good start.

MARKO ANDRIC
Hobart, Tasmania

In addition to the Snow Leopard Conservancy and the Snow Leopard Trust, readers interested in this spectacular predator should be aware of the excellent work being done by the Padmaja Naidu Himalayan Zoological Park in Darjeeling, India—where in addition to programs for the big cats, there are also successful breeding programs for the red panda and the Tibetan wolf. And where I learned that the tongue of a snow leopard feels exactly like the tongue of your favorite house cat.

ALAN DEAN FOSTER
Prescott, Arizona

Nudibranchs: Living Color

If this story had been headed "Strange Creatures Discovered on Mars," one would be tempted to believe it was a miraculous discovery. Even more miraculous is that these creatures live on our beautiful, unique, and diverse planet, worth preserving at all costs.

GEORGE FLORENCE
Melbourne, Victoria

But I'm certain that he was able to read between the lines, because nine months and four days after the postcard was mailed, Maria and Giddy (now Mr. and Mrs.) had their first child.

Thank you for your article on nudibranchs. My mother, sister, and I all sat on the couch and chose our favorite slugs. We particularly liked the ones that looked like they were smiling. How ironic that an animal that looks so much like sweet candy is that way because it is toxic.

TESSA HUTTENLOCHER
Clarkston, Michigan

Geography: Last Colonies

I noticed that several French territories were omitted from your map of the last colonies, including French Guiana, Tahiti, and the Kerguelen Islands. Why?

ADAM LECHOWSKI
Santa Rosa, California

You listed the last colonies, but you missed one. Possibly the oldest colony in the world is Puerto Rico.

FELIX LOPEZ
Boquerón, Puerto Rico

I see that there was mention of the United Kingdom but nothing about her colonies of Northern Ireland, Wales, Scotland, and several others.

TERENCE P. HANNIGAN
Newburgh, New York

Our story included only the list of 16 "non-self-governing territories" designated by the United Nations General Assembly. Many other places—though they may well fit a more general definition of a colony—do have some form of self-government, and so do not appear on the United Nations list.

Culture: Postal Modern

Your "divided back" penny postcard reminded me of a 1910 penny photo postcard that I treasure. Without it, I might not be here. Pictured are Maria Alina Andersdotter Häggman and Nilds Gideon Karlsson Björk, young Swedish emigrants from Finland who met in New York City. Maria addressed the card to G. Björk at his address in Harlem. I don't know enough Swedish to read it all, but it begins with "Many thanks"—no doubt for their date at North Baden beach, where the postcard was made. But I'm certain that he was able to read between the lines, because nine months and four days after the postcard was mailed, Maria and Giddy (now Mr. and Mrs.) had their first child. My mother was their third.

JOAN MURRAY
Old Chatham, New York

THE AMERICAN DREAM COULD USE A DOCTOR.

Right now a lot of Americans are struggling. People are worried about the future, not just for themselves, but also for their children and grandchildren. They sense that the American Dream is coming apart at the seams. And for good reason.

Many people are just one illness away from financial ruin, or they are already there. Many don't sign up for their company health care plan, if there is one, because it takes too much out of their paycheck.

And American businesses are struggling to compete because of the high cost of health care that foreign companies don't have to pay. We have outstanding doctors and nurses, the best technology and good medicines, but our system doesn't work for the people who need it most.

Some politicians say the aging of America is the problem, but the experts know better.

The head of Congress's own budget office points out that it's soaring health care costs — not the older population — that's the problem. We're spending $2.3 trillion on health care a year, and that number is climbing. There are plenty of sound policy ideas on how to fix this mess: more information technology (every other part of society is ahead of the health care system in this area); more investment in prevention and wellness; better management of chronic illnesses; and providing care that is effective, not wasted (appropriate care is received only a little more than half the time). And while it's true that we need to get everybody covered with health insurance, alone that is not enough.

Today there is new hope and renewed determination. Americans have rallied around this issue and are demanding solutions for accessible, affordable, quality health care.

So why can't we move forward? Because we are caught up in finger pointing, apathy and political paralysis.

We can solve these problems by getting involved and pushing our elected officials toward change. We can hold the candidates accountable for their promises of health care reform and make it a priority in the next administration and the next Congress. Let's be ready.

During the past 50 years, AARP has been at the forefront of advancing the cause of health care in America, and we're even more committed to solutions for the challenges of the 21st century.

Ultimately, we will help make it possible for all Americans to have access to affordable, quality health care. We are determined to make this part of the American Dream a reality once again.

We're working hard by advocating and laying the groundwork. But we need your help. Get involved and make a difference.

For more ideas on how you can help improve the ailing health care system, go to aarp.org/champion.

AARP 50+

The Elephant in the Room Have you sent a photograph to Your Shot yet? Every weekday our editors select 12 reader-submitted images and post them on our website. Then their favorite images, along with yours—readers may select shots using the Your Shot Voting Machine—are published on this page every month. For guidelines, a submission form, and more information go to *ngm.com/yourshot*.

Brent Lewin Toronto, Ontario

Farmers' elephants like this one often wander through an abandoned development in Bang Bua Thong, Thailand. Dust from rubbing up against the concrete walls powders this one's hide. But, says photographer Brent Lewin, 28, "the elephants are washed daily."

Daniel Brim Boston, Massachusetts

A three-second exposure caught lightning scrawled across the Boston sky for Daniel Brim, 20, ■ student at Northeastern University. This photo was voted an *ngm.com* audience favorite.

YOU CAN'T SPEED UP TIME.
BUT THERE ARE PLACES IT WILL SLOW DOWN.

I LIKE THINGS BUT HERE
NOT I CAN'T ANYWHERE ELSE. IT'S AMAZING
HOW MUCH WEIGHT COMES OFF MY SHOULDERS
JUST BY CARRYING A KAYAK ON ONE OF THEM.

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Women in the Israeli army train (and snack) together—then serve alongside men.

Rachel Papo's images of women in the Israeli army appear in Serial No. 3817131, *published by powerHouse Books. More of her work can be seen at* rachelpapo.com.

Women Warriors In 1988 I entered basic training as soldier number 3817131 in the Israeli army. I was 18 years old. Since the Arab-Israeli war of 1948, both men and women have been required to serve in the military.

The two years I spent as a soldier weren't easy. I struggled with the army's ways. Fourteen years later, as I began my photojournalism career in New York City, I decided to return to Israel with my camera. I hoped to make sense of that period of my life by visiting army bases to look at how young women today were coping. It was a little bit strange for me. I was so much older than the girls I photographed, and they didn't think of me as one of them. If anything, they saw me as just some lady from New York —even though I'm an Israeli too.

But the project isn't so much about Israel for me. It's about the complex and delicate spectrum of adolescent emotions. I get a lot of response about this work, and people all over the world seem to relate to it. "I think your photographs depict the reality of ■ military person's life, regardless of gender," one Vietnam War veteran wrote me. "I am one who believes the differences among us are fewer than we imagine."

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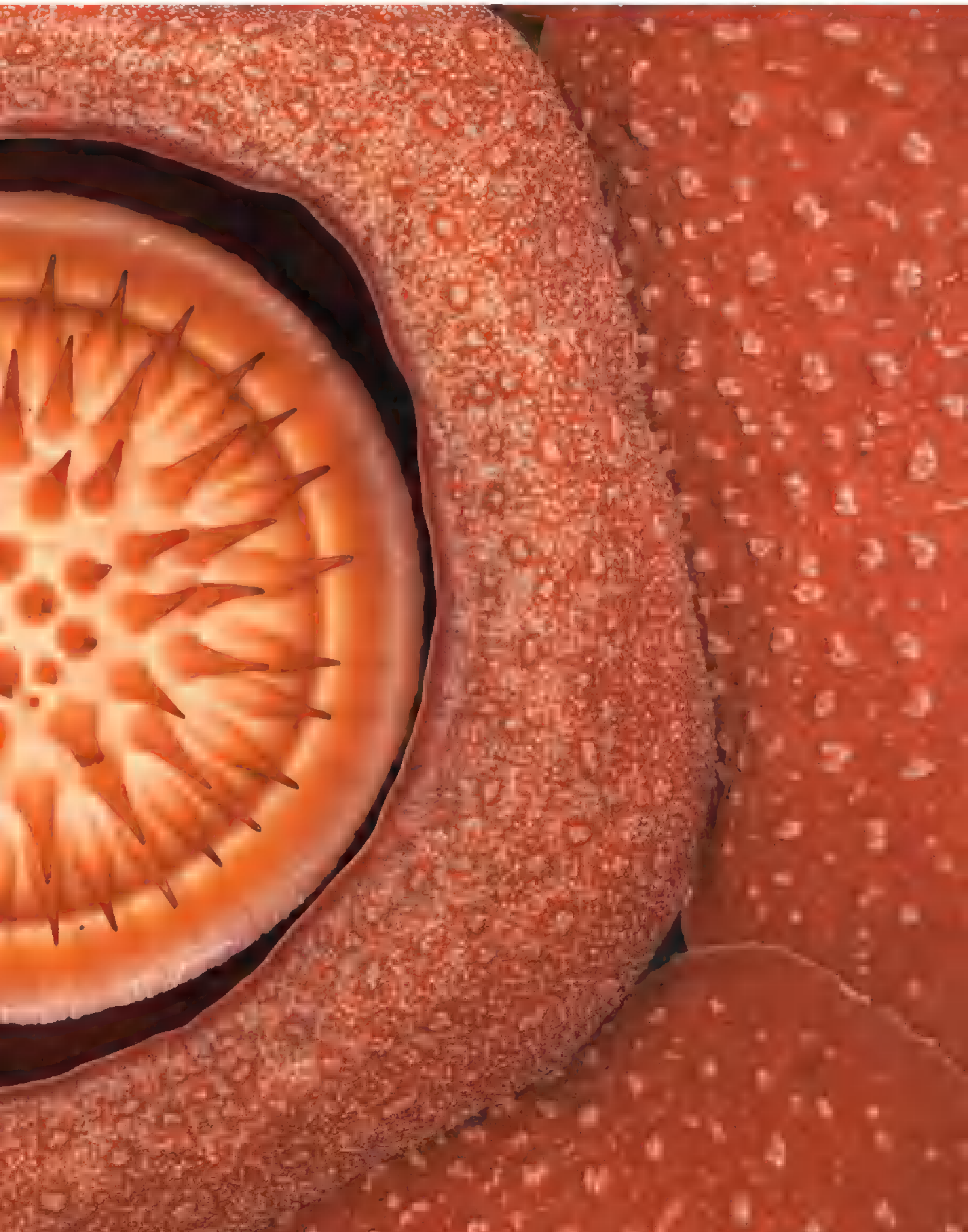
Norway Bright beaks and feet signal the breeding season for Atlantic puffins on Hornøya Island. The birds' colors dull for winter. Puffins in summer and winter coloration look so different they were once thought separate species.

PHOTO JAN VERMEER, FOTO NATURA

Malaysia Spikes at the center of the *Rafflesia kerrii* flower may help disperse its odor—the stench of rotting meat—throughout its jungle habitat, attracting the carrion flies that pollinate the platter-size bloom.

PHOTO: INGO ARNDT, MINDEN PICTURES/NG IMAGE COLLECTION



Sudan Women walk miles from their West Darfur refugee camp—and risk assault by roving militiamen—to gather wood and grass for fuel. A full sack earns some 50 cents in their camp, home to about 15,000 people.

See more Visions of Earth images at **visionsofearth.ngm.com.**

PHOTO J CARRIER

"I WAS COMPLETELY ANTI INSULIN NOW I'M ALL FOR IT."

Important Safety Information About Insulin

Possible side effects may include blood sugar levels that are too low, injection site reactions, and allergic reactions, including itching and rash. Tell your doctor about all other medicines and supplements you are taking because they could change the way insulin works. Glucose monitoring is recommended for all patients with diabetes.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch, or call 1-800-FDA-1088.

GREG PFAFF	TYPE DIABETES	INSULIN PATIENT SINCE 2003

I USED TO THINK:
I was in the prime of life, running a successful deli, when I was diagnosed with diabetes. My biggest fear was that taking insulin would somehow interrupt my life—keep me from doing what I loved.

NOW I THINK:
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MY ADVICE:
When my doctor suggested insulin, I was resistant. Now I wish I had started it earlier. If your blood sugar's not controlled, there's no reason to wait to talk to your doctor about whether insulin is right for you. Insulin isn't the enemy—it may be the answer you're looking for.

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Balls are rubbed with mud before every major league baseball game.

"Magic mud" is dug in New Jersey.

The Dirt on Baseball Hours before ■ game, beneath major league baseball's newest stadium, one of the sport's oldest rituals is under way. Two Washington Nationals batboys are rubbing brown gunk on dozens of new balls, toweling them off once the wet dirt cakes. Only when they're done can the umpire yell, "Play ball!"

Lena Blackburne Baseball Rubbing Mud has been helping pitchers get a grip for 70 years. After a wild pitch killed a batter in 1920, a tacky substance was sought. Shoe polish and tobacco juice didn't stick. What did was the feldspar-rich clay found in a New Jersey swamp by player and coach R. A. "Lena" Blackburne. In 1938 it became a big-league staple; in 1968 it made the Hall of Fame.

The company reaps six harvests a year from two holes in secret spots (left), filters out debris, and adds a "magic" ingredient for extra grip. Aged for six weeks, two three-pound vats are sent to each team—a season's worth of joy from Mudville. *—Jeremy Berlin*

PHOTOS: REBECCA HALE, NG STAFF (TOP); LENA BINTLIFF

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FOOD

Rapid Rise Peruvian soldiers, prisoners, and schoolchildren now eat *papapan*—a bread made with boiled potatoes. The government is promoting the product in the wake of a global wheat shortage caused by bad weather and demand from the growing world population.

As the cost of wheat flour soars, the poor suffer the most. In Nigeria a small loaf is now a dollar, up from 75 cents in 2007. "We should use this year as an alarm bell," says UN economist Abdolreza Abbassian. People seem to be listening. Wheat plantings have increased almost everywhere. *—Catherine L. Barker*

Around the world, bread prices have been affected by the cost of wheat, which doubled in the past year. The figures above are estimates.

PHOTO: MARK THIESSEN, NG PHOTOGRAPHER

You Can't Say That Turkey wants to join the European Union. But the EU has many demands, including a reform of the country's insult laws, which stifle free speech by making it a crime to deride Turkishness, ■ public figure, or the republic's founder, Atatürk. Turkey is trying to comply. Insulting Turkishness is no longer a crime, though insulting the republic is. And the justice minister must OK any prospective cases. The EU is still deciding.

Such laws date to ancient Rome. Akin to libel laws but designed to protect the "honor" of public officials, they're now a political tool. Even if never enforced, they take a toll, says Javier Sierra, who leads a World Press Freedom Committee campaign to quash them. The threat of a fine or jail time can "scare the hell out of a newspaper." Or a website. In 2007 Thailand made noises about filing suit over an online video depicting its king as a monkey. *—Marc Silver*

COSTLY INSULTS
Over time and around the world, insult laws have dampened public debate. Sentences have included $1.1 million in fines (Azerbaijan), 74 lashes (Iran).

"University of Terrorism"

EGYPT (2006) Student blogger Abdel Kareem Soliman is brought to trial for insulting his school, Islam, and Egypt's president.
Outcome Four years in jail

"The Great Humbug: The Christians' Christmas"

NORWAY (1912) The editor of the *Free Thinker* uses this headline.
Outcome A ten-kroner fine

"El esposo gordo"

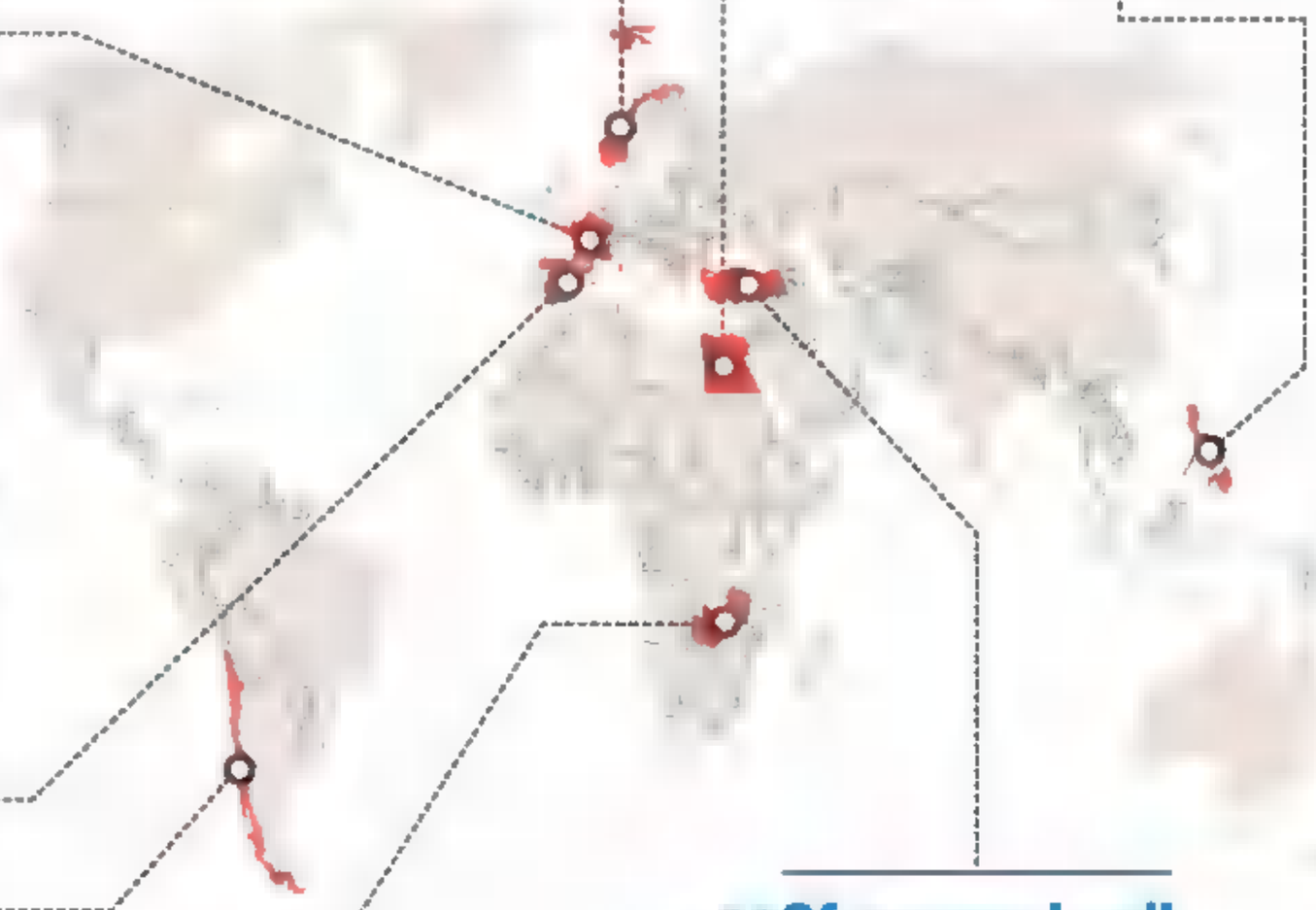
PHILIPPINES (2004) A writer calls the president's husband "the fat spouse."
Outcome A trial on damage charges, which are later dropped

"Hoo hoo"

FRANCE (mid-1960s)
A spectator hoots a French "boo" at Charles de Gaulle.
Outcome Arrested

"Linked to drug trafficking"

SPAIN (1995) A newspaper connects Morocco's King Hassan II to a truck, owned by the royal crown, carrying five tons of hashish. A Franco-era law lets the king sue for the insult to his honor.
Outcome Three Spanish courts rule for Hassan; an appeal to ■ European court is pending.



"Cowardly"

CHILE (2001) A TV pundit attacks the country's justice system.
Outcome A $460 fine, a suspended sentence. Charges are later dropped; Chile reforms its insult laws.

"A twit"

ZAMBIA (1994) Two reporters quote an ex-minister's insult of the president.
Outcome The reporters are arrested.

"Of course I call this genocide."

TURKEY (2006) In an interview with Reuters, journalist Hrant Dink uses this label for the Ottoman Empire's killing of up to 1.5 million Armenians.
Outcome Dink is assassinated while on trial for insulting Turkishness.

GRAPHIC: OLIVER UBERTI, NG STAFF SOURCE: WORLD PRESS FREEDOM COMMITTEE

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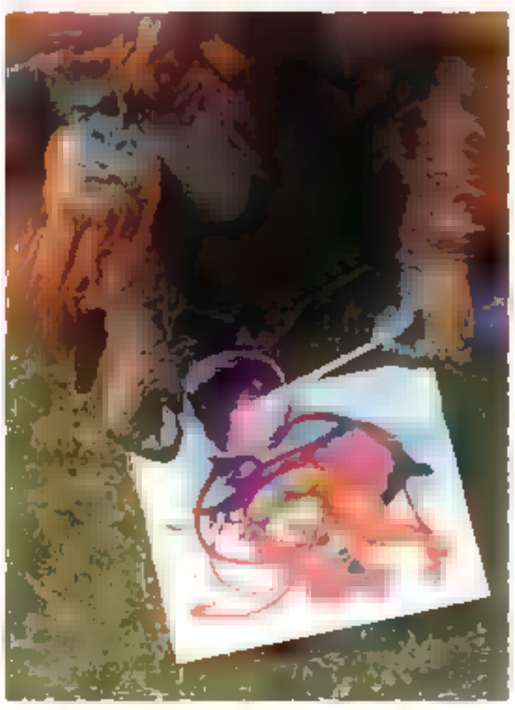
At Zoo Atlanta, computer games exercise orangutans' brains while recording data on how they think.



Atlanta's apes get creative, picking their paint colors and using brushes, fingers, and even lips to doodle.

Zoos, Improved Tiger attacks, monkey escapes, animal deaths—zoo news has been giving critics a platform. "I'd like to see all zoos phased out," says biologist Marc Bekoff, an animal-protection advocate. Barring that, "zoos need higher standards. And some animals don't belong in captivity at all."

"Enlightened zoos are good places," counters psychologist Terry Maple, director of Florida's Palm Beach Zoo. "And we're getting better." Input from scientists has led to more naturalistic enclosures that reduce lethargy and elicit healthy behaviors. Hiding places give refuge from the eyes and taunts of zoogoers, while varied habitat and food options let animals make choices. Even computer games "challenge animals to solve problems as they do in the wild," says Zoo Atlanta primatologist Tara Stoinski.

One result is animals that "jump farther, climb higher, run faster," says zoo architect Pat Janikowski. So exhibits may need higher walls and deeper moats to thwart escapes—and more roaming space. A few zoos are phasing out elephant exhibits, which hog land and funds. Others are still game: In 2011 the National Zoo in Washington, D.C., will open its $40-million Elephant Trails. *—Jennifer S. Holland*

PHOTOS: PETER ESSICK

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Color Theory Last fall in New England was warm and dry. Foliage fans swore the autumn palette was drab. Their conclusion: Climate change is killing fall color.

Scientists aren't so sure. Comparing intensity of color from one year to the next "is very difficult," says ecologist John O'Keefe of Harvard Forest in Massachusetts. Even what drives color change is up for debate. "We have new ideas, but much is still a mystery," says botanist David Lee of the National Tropical Botanical Garden.

Now researchers are studying how climate change affects color from year to year. They're tracking the onset of autumn hues and training webcams on trees to gauge intensity. All they know now is warmer temperatures have delayed the fall show a few days—so far.

The forecast for this year is anyone's guess. One thing's certain: Weather always plays a big role. Drought can cause leaves to turn brown and drop off early; cloudy days can slow the creation of red pigment. As for the long run, ■ balmier Northeast would be bad for cold-loving, colorful sugar maples: Old trees would hang on, but seedlings and saplings wouldn't thrive. So don't delay that Vermont foliage tour until 2058. *—Marc Silver*

FALL'S FORMULA
Shorter days, chillier nights, and ample sun likely spark color change.

GREEN
It's the shade of the chemical chlorophyll, which enables leaves to turn CO_2 into sugars.

YELLOW
Typically lurking under the green, it's unmasked as chlorophyll breaks down in aging leaves.

ORANGE
If newly produced red pigments aren't dominant, they blend with the newly revealed yellow.

RED
Why do aging leaves expend energy to make this hue? Perhaps to repel egg-laying bugs or guard nutrients from sun damage so the tree can retrieve them.

PHOTO: CARY WOLINSKY

Saab XWD lets you get the most out of your adventures:

FOOD: In the scenic Hudson River Valley 30 miles north of Manhattan, Blue Hill at Stone Barns features an award-winning restaurant set amidst an 80-acre farm. *630 Bedford Road, Pocantico Hills, www.bluehillstoneborns.com*

MUSIC: A national landmark, the Art Deco-style Beacon Theatre opened in 1929. It still hosts the greatest names in music, thanks to superior acoustics (Martin Scorsese's recent Rolling Stones concert movie was filmed here). *2124 Broadway, www.beacontheatre.com*

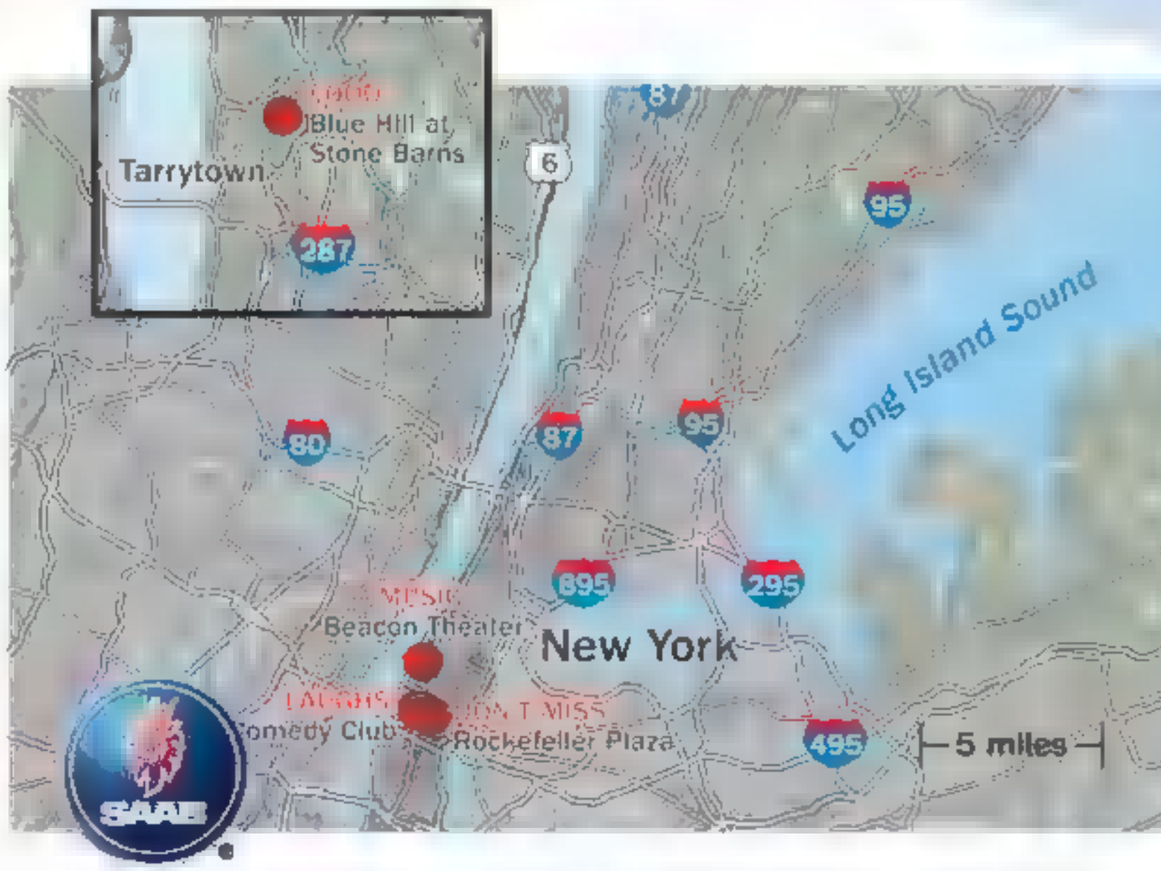
LAUGHS: Top names in comedy perform at the New York Comedy Festival from November 5-9. Last year's line-up included Conan O'Brien, Rosie O'Donnell, Sarah Silverman, and the Upright Citizens Brigade. *Multiple venues, www.nycomedyfestival.com*

DON'T MISS: Get a jet's view of the Manhattan panorama from the calm 70th-floor Top of the Rock observation deck. *From 47th to 51st Streets, Fifth to Seventh Avenues, www.rockefellercenter.com*

MUSEUM: A medieval sanctuary transplanted to upper Manhattan, The Cloisters are part of The Metropolitan Museum of Art. The collection includes works dating from the ninth century; the circa-1495 Unicorn Tapestries are its prized possessions. *Fort Tryon Park. www.metmuseum.org/cloisters*

SIDE TRIP: Several small towns in New Jersey—Lambertville, Red Bank, Englishtown, Burlington—are known as prime hunting grounds for antiques hounds. Come early for the best finds, late for the bargains. *https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp*

LANDMARK: The Brooklyn Bridge opened in 1883, uniting Manhattan with the outer boroughs. One of the oldest suspension bridges in the U.S., this engineering marvel and NYC icon is a National Historic Landmark that still carries pedestrians, cyclists, and some 126,000 cars daily across the East River. *Park Row. www.nycroads.com/crossings/brooklyn*



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Saab XWD lets you get the most out of your adventures:

FOOD: Savor seafood with a sea view at Waterbar, a new restaurant on the Embarcadero whose tall windows overlook San Francisco Bay. The signature dish is Rock Cod "Colbert," a gourmet interpretation of fish-and-chips. *399 Embarcadero, www.waterbarsf.com*

MUSIC: A year-old, two-story jazz club in the Fillmore distnct, Yoshi's attracts the genre's greatest living artists, who revel in the room's superb acoustics that are unmatched except by Saab's quiet package. *1300 Fillmore Street, www.yoshis.com*

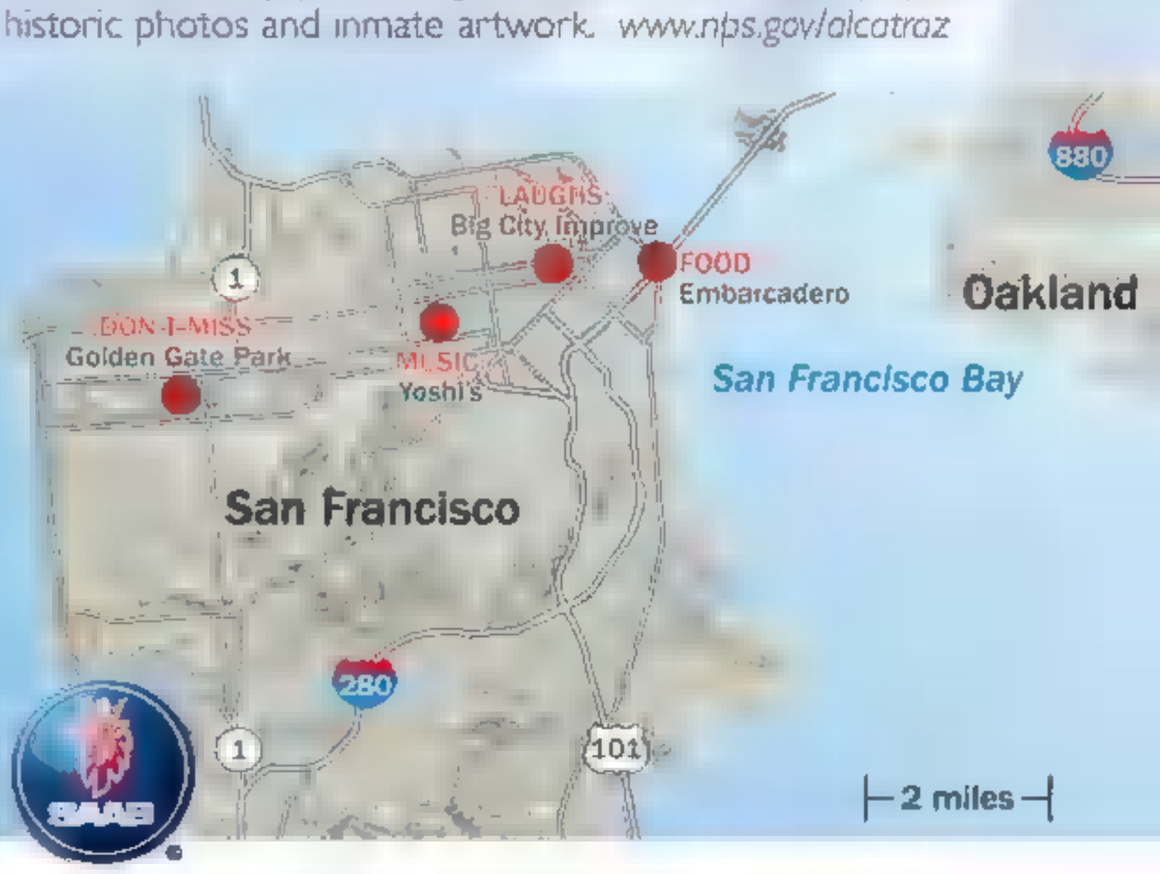
LAUGHS: The award-winning troupe at Big City Improv nffs unscripted on just about any topic, and audience participation is welcome (just try and stump 'em!) *533 Sutter Street, www.bigcityimprov.com*

DON'T MISS: Golden Gate Park, San Francisco's urban oasis, contains the Victonan-style Conservatory of Flowers, a Japanese Tea Garden, the de Young fine arts museum, and nearly a million trees. *www.sfgate.com/traveler/guide/sfneighborhoods/ggpark.shtml*

MUSEUM: Reopened this September after a major renovation that made it sustainably green, the California Academy of Sciences holds an aquarium, a planetarium, and a natural history museum under its grass-covered roof. *55 Music Concourse Drive, www.calacademy.org*

SIDE TRIP: Towering, thousand-year-old redwood trees stretching up to 260 feet tall dwarf visitors to Muir Woods National Monument. Put the top down on the Saab 9-3 convertible and be closer to the sky as you drive twelve miles north of the Golden Gate Bridge to wander among these giants. This cool refuge from the city has miles of hiking trails. *Mill Valley, www.nps.gov/muwo*

LANDMARK: Flocks of seabirds have replaced convicts on Alcatraz Island, home of the infamous federal penitentiary. Tourists who ferry to "The Rock" can embark on self-guided tours of the empty, haunting prison that includes displays of historic photos and inmate artwork. *www.nps.gov/alcatraz*



For additional cities, Cross Drive activities in San Francisco, and to submit YOUR OWN experience log onto:
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Trip Notes:

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Let your San Francisco adventures take flight...
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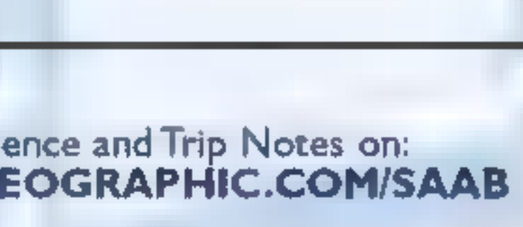

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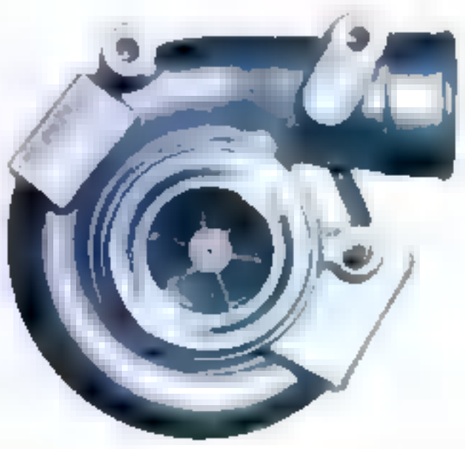
We believe every person should recycle. And so should every engine.



Why on earth throw something away when you can use it to make something better? That's the simple idea behind the Saab Turbo. By taking exhaust that typically escapes out of the tailpipe and redirecting it back into the engine, the Saab Turbo maximizes performance with minimal use of fuel. With an estimated 29 mpg hwy* in the 2009 9-3 2.0T Sport Sedan. We always knew recycling was a powerful thing. The Saab Turbo. The perfect balance of efficiency and performance.

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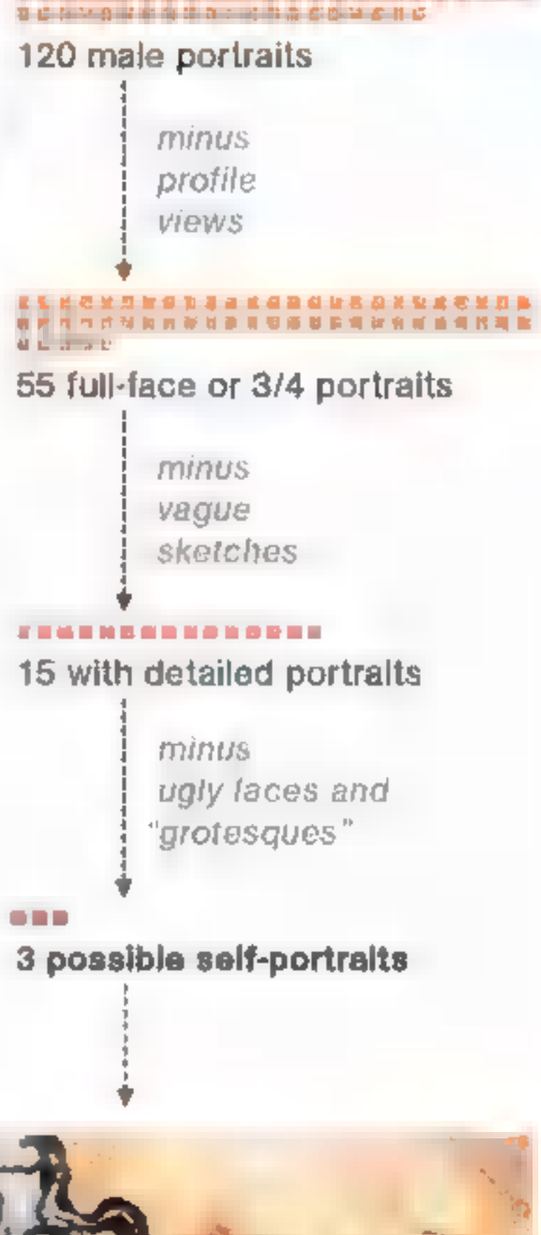
*Official EPA estimate not yet available. Fuel economy estimate based on GM testing. **MSRP. Tax, title, license, dealer fees and optional equipment extra.

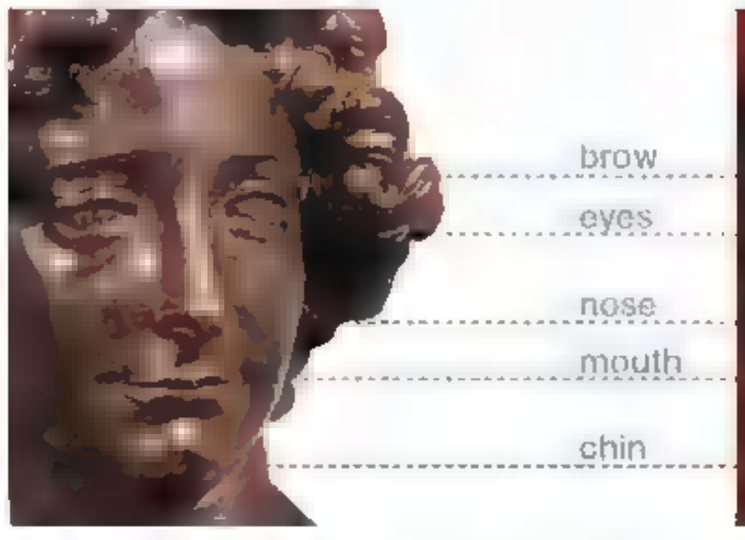
A New Look at Leonardo

Leonardo da Vinci drew the world around him almost compulsively, leaving a legacy of hundreds of pieces of art. Yet in all this work there is not a single uncontested self-portrait. Many experts have concluded that Leonardo never drew himself. But I think perhaps he did. I'm not an art historian, but I do know portraits: I've drawn more than 1,100 for various publications over 30 years. In search of Leonardo, I looked at more than 700 of his drawings and paintings and found 120 that show male faces. A proper self-portrait shows a full face or three-quarter view. Of these 120 drawings of men, 55 did. A self-portrait must be detailed; of the 55 nonprofile drawings, 15 met this standard. And I thought the face should be attractive—contemporaries described Leonardo as handsome. Only three portraits (below) of the 15 fit all these criteria: "Portrait of a Musician," "Vitruvian Man," and "Turin." All share striking features, including a broad forehead, high-set nose, and small mouth. What's more, Leonardo's approximate age when he likely made each—33 in 1485, 38 in 1490, and 61 in 1513, respectively—seems to correspond to the age of the men portrayed. Are they Leonardo? Looks like it to me. *—Siegfried Woldhek*

DIGGING FOR DA VINCI

Artist Siegfried Woldhek combed Leonardo's works for self-portraits, narrowing the field to three.





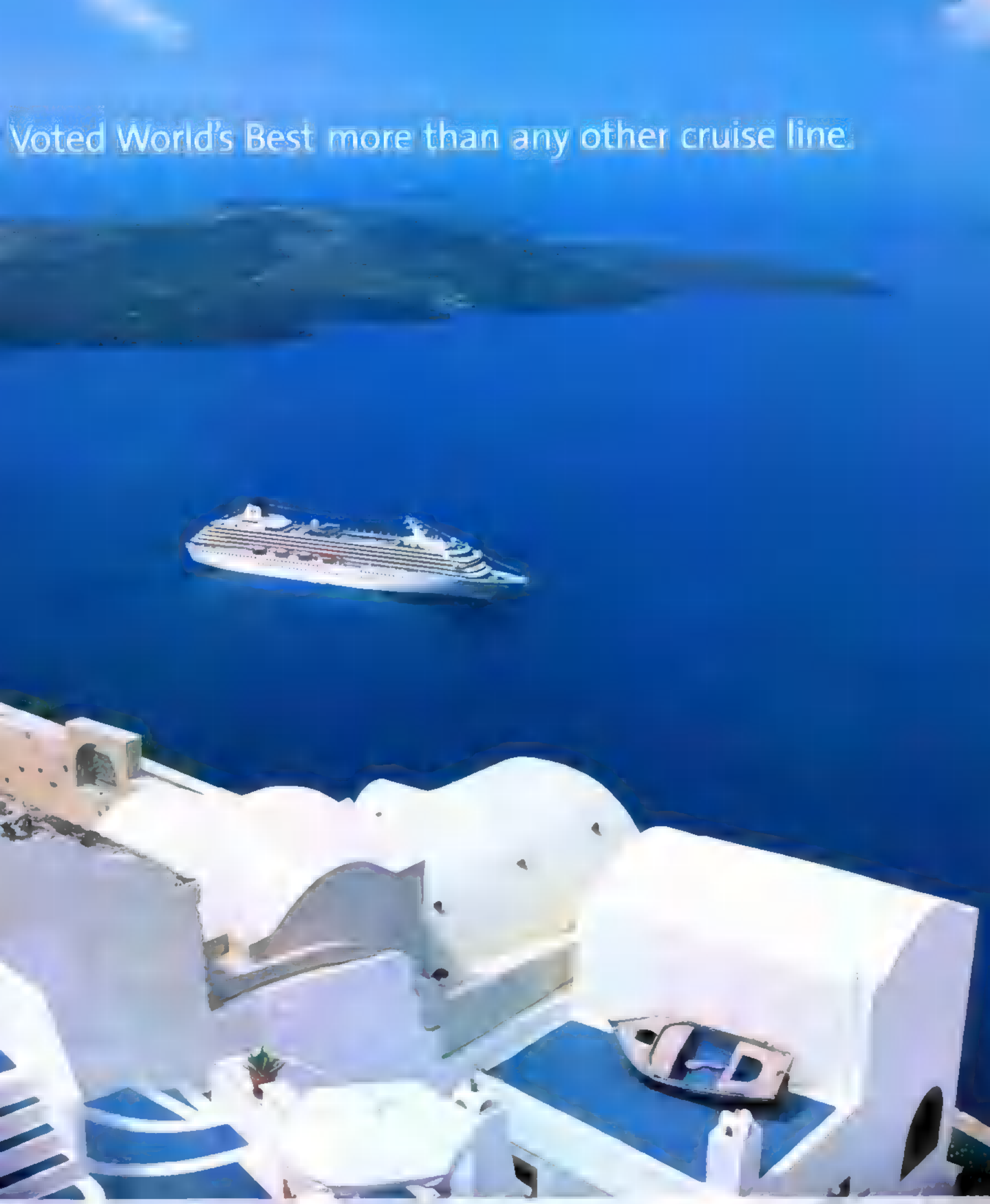
Some experts believe Leonardo posed for Verrocchio's "David," sculpted circa 1467.

"Portrait of a Musician" painted circa 1485

"Vitruvian Man" drawn circa 1490

"Turin" portrait drawn circa 1513

PHOTOS: SCALA/ART RESOURCE ("DAVID" AND "MUSICIAN"); ALINARI/ART RESOURCE ("VITRUVIAN MAN" AND "TURIN")



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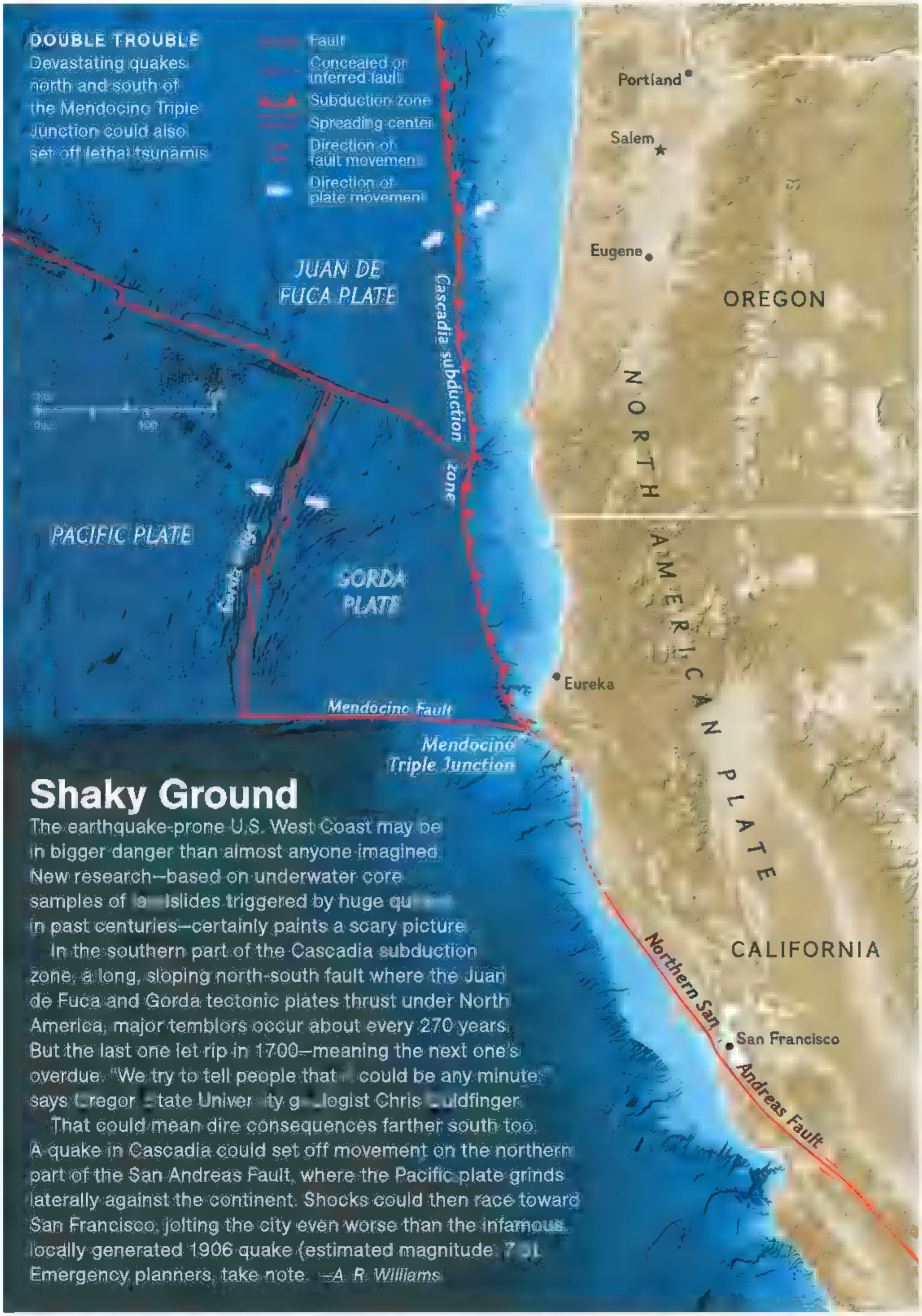

Shaky Ground

The earthquake-prone U.S. West Coast may be in bigger danger than almost anyone imagined. New research—based on underwater core samples of landslides triggered by huge quakes in past centuries—certainly paints a scary picture.

In the southern part of the Cascadia subduction zone, a long, sloping north-south fault where the Juan de Fuca and Gorda tectonic plates thrust under North America, major temblors occur about every 270 years. But the last one let rip in 1700—meaning the next one's overdue. "We try to tell people that it could be any minute," says Oregon State University geologist Chris Goldfinger.

That could mean dire consequences farther south too. A quake in Cascadia could set off movement on the northern part of the San Andreas Fault, where the Pacific plate grinds laterally against the continent. Shocks could then race toward San Francisco, jolting the city even worse than the infamous locally generated 1906 quake (estimated magnitude 7.9). Emergency planners, take note. —*A. R. Williams*

NGM MAPS. SOURCE: CHRIS GOLDFINGER, JASON CHAYTOR, AND CHRIS ROMSOS, OREGON STATE UNIVERSITY


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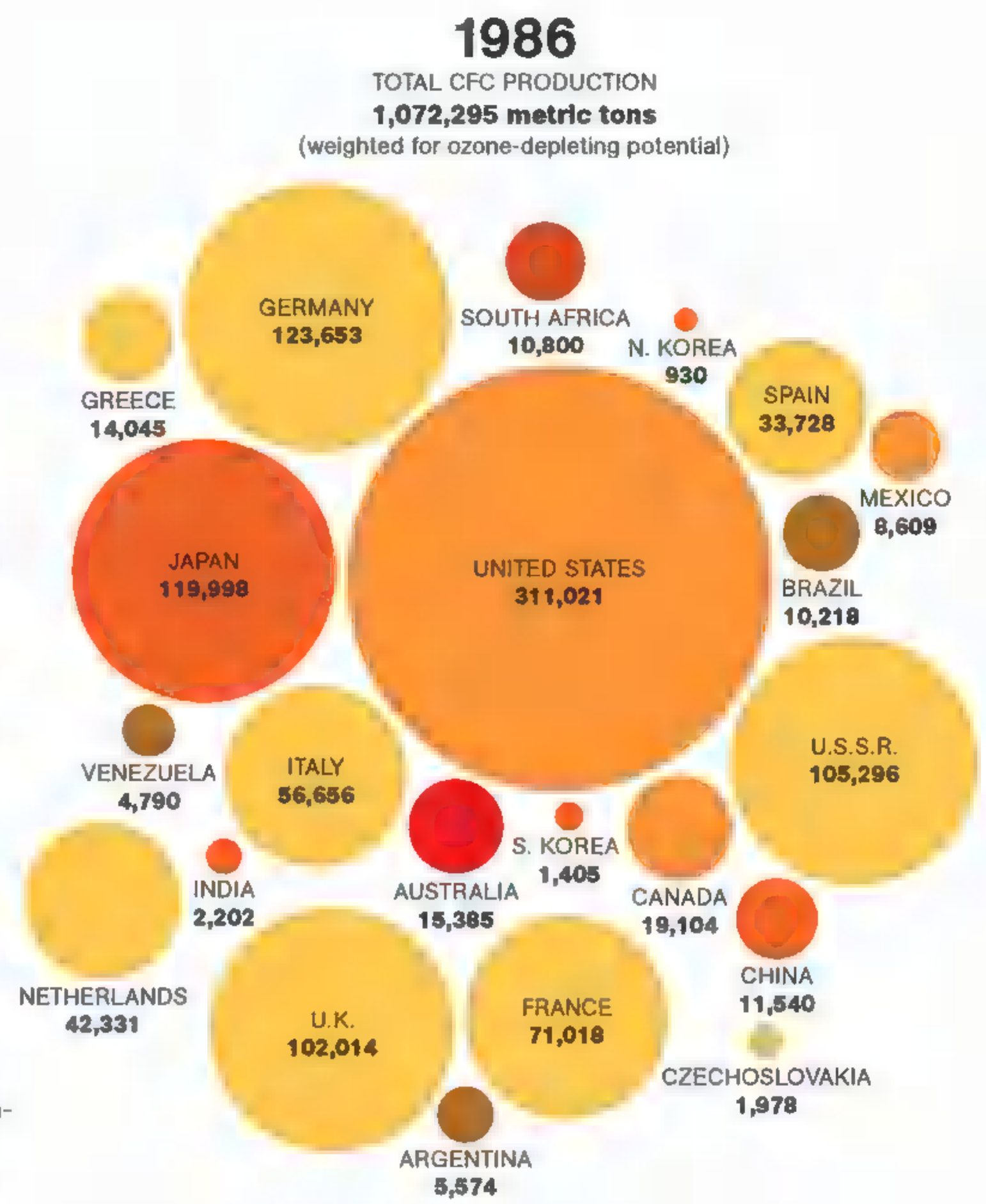
Ozone Defense

Before headlines tracked melting Arctic ice, they warned of a gaping hole in the sky above Antarctica. The culprit wasn't SUVs but CFCs—chlorofluorocarbons, used for everything from hair-spray propellant to refrigerator coolant. The chemicals were cheap and nontoxic. Then in the 1970s they were linked to the destruction of the atmosphere's ozone layer, which shields against harmful ultraviolet light.

An effort to eliminate the chemical compounds began. The 1987 Montreal Protocol has so far pledged 193 governments to stop making and using CFCs and other ozone depleters—a record number of parties for an environmental treaty. Production of CFCs is down nearly 97 percent compared with 1986.

Phasing out ozone depleters will eventually shrink the hole, but scientists don't expect to see it on the mend until 2050. In 2006 it was ■ record 11.4 million square miles, nearly as big as Africa. Julian Newman of the nonprofit Environmental Investigation Agency says the next task is closing rogue factories that feed a $50-million-a-year Asian black market in CFCs for old appliances. *—Shelley Sperry*



GRAPHIC: OLIVER UBERTI, NG STAFF
SOURCE: UNITED NATIONS ENVIRONMENT PROGRAMME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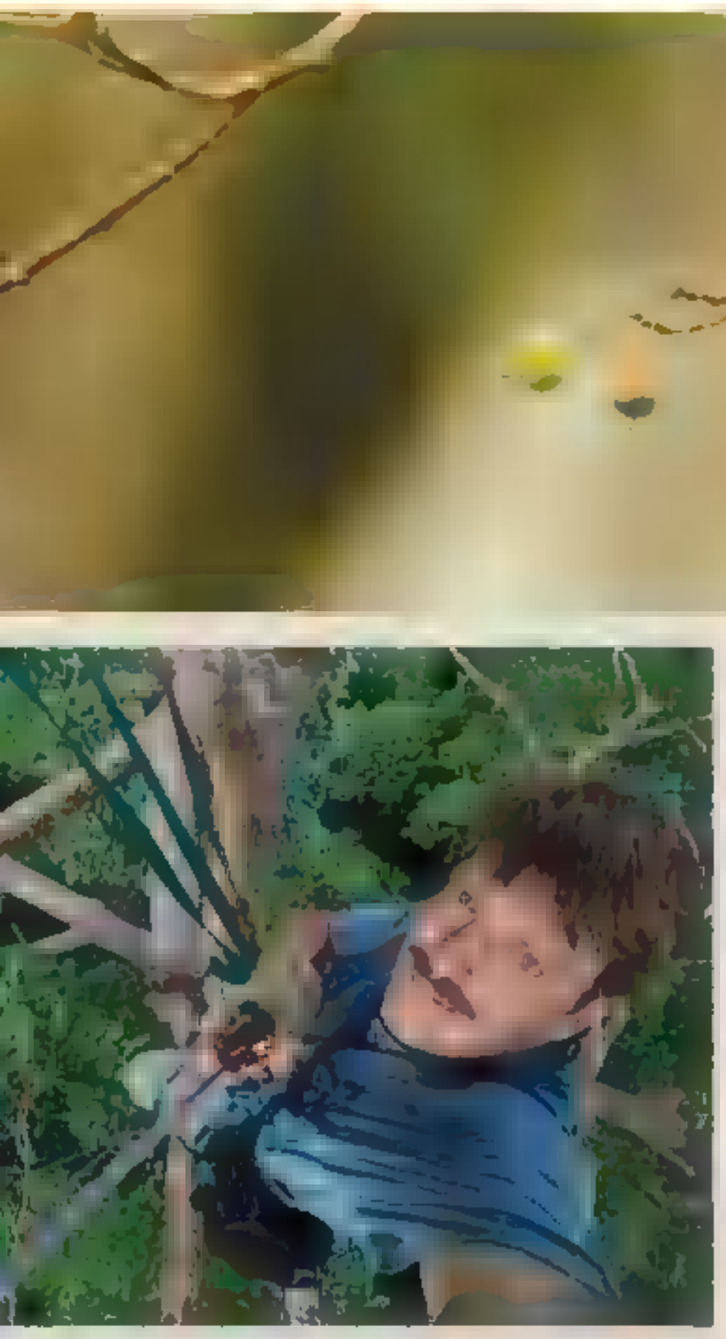

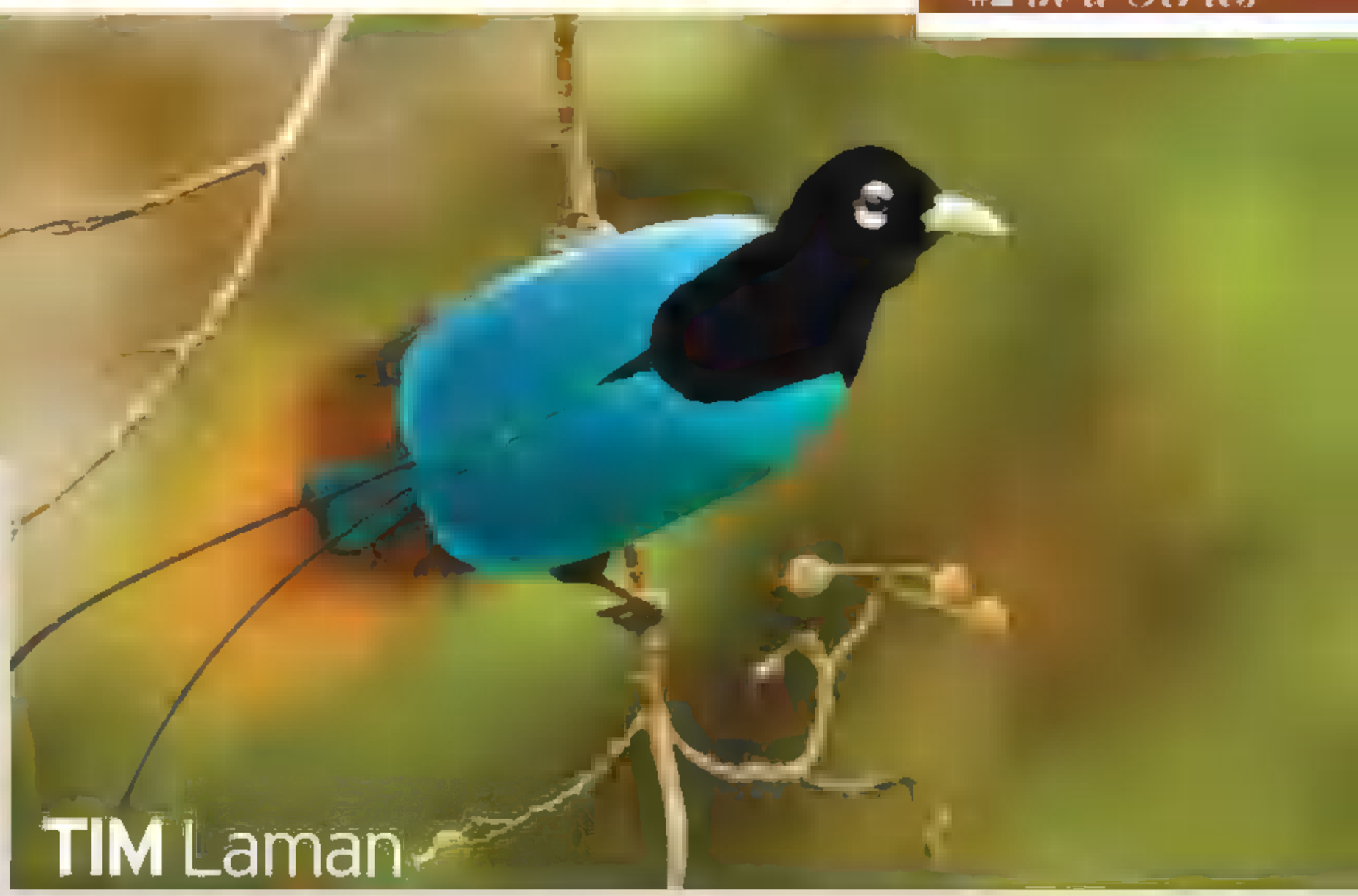

TIM Laman

A WILD Life

has helped

conservation

Tim Laman never set out to be a world-class photographer. When he graduated college he just wanted to do what he loved best: experience the natural world. Although he was driven to succeed, plotting a career didn't make the top of his agenda. Instead, Laman's enthusiasm for animals, birds, and marine life naturally led him toward an award-winning career in photography.

It was while working on his Ph.D. in biology at Harvard—he was researching strangler fig trees in the rain forest canopies of Borneo—Laman created the subject for a *National Geographic* photo piece. "I turned my research project into my first major published work," says Laman. Although his work as a biologist and a photographer (he's self-taught) go hand in hand, Laman believes choosing to pursue photography was a good decision that has allowed him to work on a variety of subjects. "In science you really have to specialize, but as a photographer, I am reaching a wider audience and raising attention for conservation—much more than I could have pursuing a scientific career," he says.

Laman's expeditions have produced striking photos of the world's little-known places—from orangutans in the wild to Fiji's underwater reefs to his latest project, birds of paradise in New Guinea and Indonesia (see photo above). He gets great shots because as an avid tree climber, diver, and ski mountaineer, he goes where most people don't. "People think the whole world has been explored, but really there's a lot we have to learn and appreciate."

Photographs made possible by NATIONAL GEOGRAPHIC Image Collection

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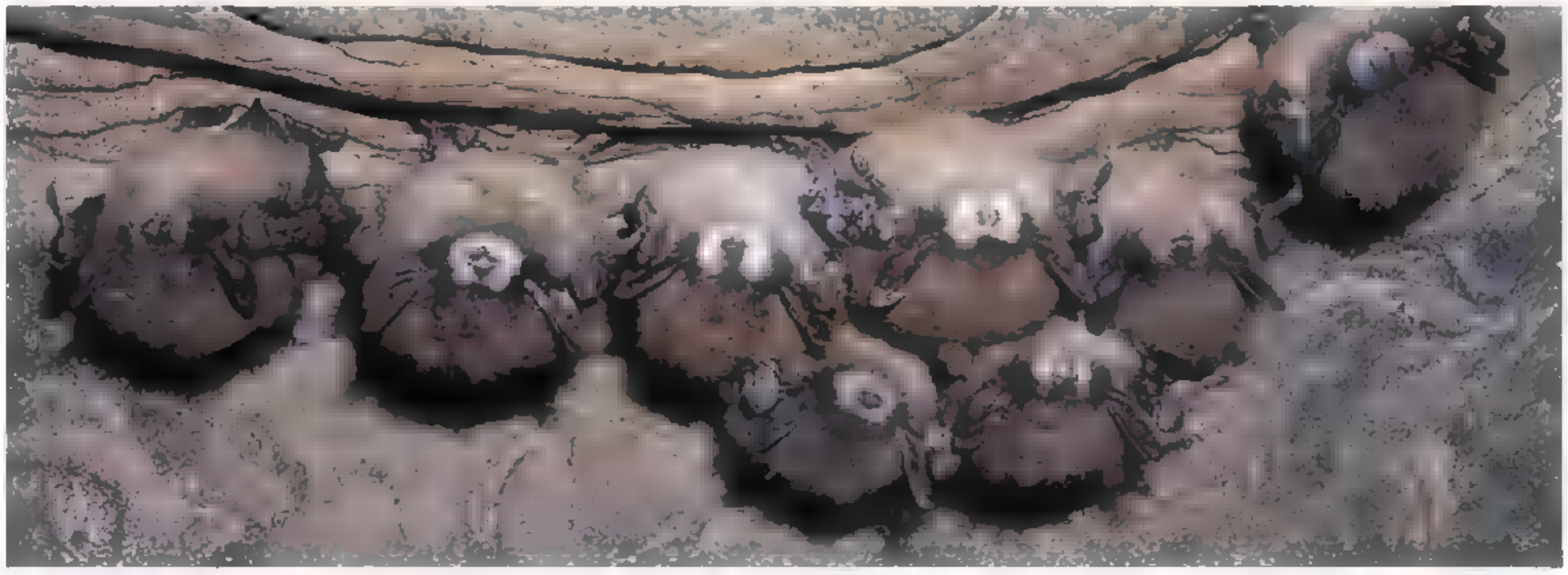
Bat Blight "I almost fell out of my chair," says Al Hicks, a mammal expert at the New York State Department of Environmental Conservation. It was March 2007, and he'd just been shown a picture (bottom) of live bats in a cave where carcasses littered the floor. No one had ever seen noses like these before.

Bats with "white nose syndrome" die during winter hibernation, apparently because they run out of fat. Some two dozen caves and mines in the Northeast are known to be affected. Now scientists are searching frantically for a cause—climate change, a virus, or some other stressor that might interfere with fat storage or make bats burn fat too fast. The white fungus on the face is probably a secondary infection.

Hicks says about 90 percent of bats in affected places die. If the syndrome spreads, it could be a disaster for the animals—and for the humans who rely on them to keep insect numbers down. *—Helen Fields*

Scientists enter an affected cave (right) in New York State. White fungus grows on little brown bats (below).



PHOTOS: MIKE GROLL, AP IMAGES (TOP); NANCY HEASLIP, NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Jess Jackson, Taylor Peak Estate, Bennett Valley

KENDALL-JACKSON

Understanding the *grand cru* concept allows us to make our wine taste even better. Simply stated, *grand cru* is the French concept of designating a specific single vineyard, estate or château as showing the highest potential for greatness. Factors that determine this distinction are the superior balance of well-drained soils, preponderance of thin soil, the micro-weather of that special place such as angle of light to the sun, and the level of exposure to warm temperatures and cooling moisture from coastal fog or mist.

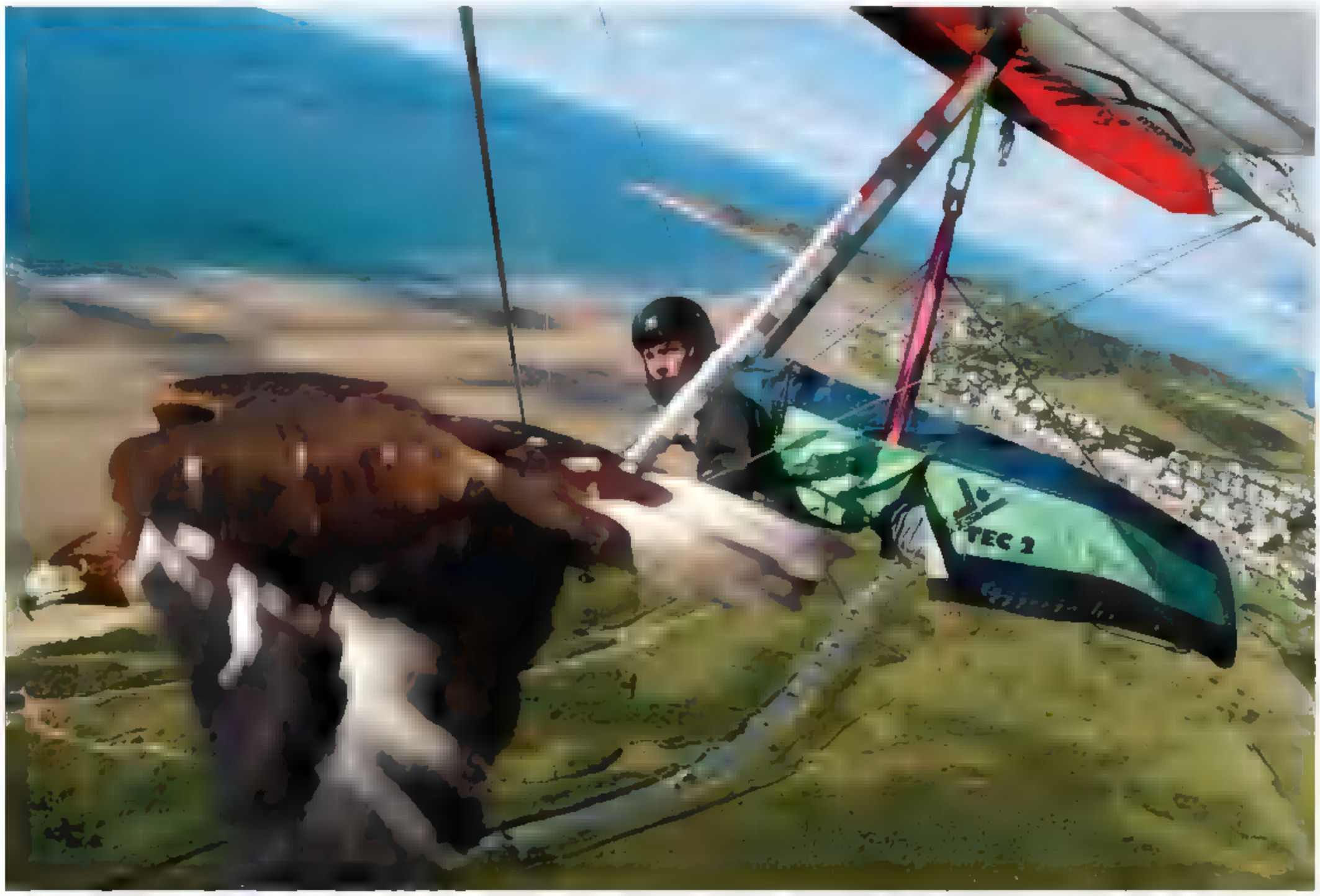
The *grand cru* concept is the approach my family and I have adopted when selecting the land that will produce our grapes.

We have found that the mountains, ridges, hillsides and benchlands along California's cool coastal region possess the ideal terroir to deliver world-class grapes with rich, intense and complex flavors. This is where you will find our Jackson Estates Grown Vineyards. We select the finest grapes from our best estate vineyards and blend them to make our highly celebrated Vintner's Reserve. In other words, the ultimate blending of *grand cru*. Because we believe you can taste the difference.

It is my understanding that many of you enjoy the taste of our wines but aren't sure why. Hopefully, I can help with the facts and **A Taste of the Truth.**

Jess Jackson

kj.com/truth

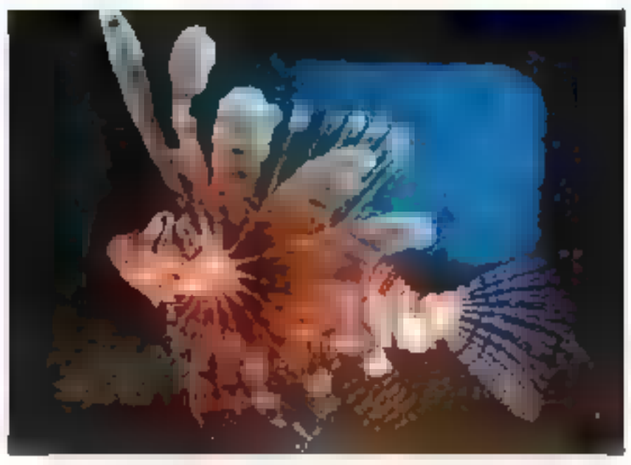


Jonathan Marshall shares a bird's-eye view of North Devon in southwest England.

Bird Guide Stolen from a British zoo and kept in an enclosed space for six months, Sampson, a ten-pound golden eagle, is now airborne in England, a friend by his side. Falconer Jonathan Marshall rehabilitated the bird, which was in poor condition and aggressive after its ordeal, and ill suited for the wild because it was bred in captivity and confined to a cage. He gained its trust with rabbit-meat handouts and hours "watching TV, making him part of the family." He then trained the eagle to soar beside his hang glider. The first time Sampson flew off to snag food was nerve-racking: "Once I set him free, I wasn't sure he'd come back." Now on nice days the pair fly in tandem for hours. "I chat with him, tell him my secrets," Marshall says. "He's a good listener." *—Jennifer S. Holland*

Watch a video of Sampson and his human flight partner at **ngm.com.**

Conservation News



Kill Gill There's an uproar over lionfish. In the early 1990s, the Indo-Pacific native first appeared off the Florida coast—some think it was released by aquarists. With no natural predators, the poisonous fish has spread north to the Carolinas and beyond and as far east as Bermuda. Up to a foot long, the lionfish now poses a threat by competing with commercial fish—or eating them. To figure out its Atlantic habits, U.S. researchers have asked divers to report sightings. In the Bahamas the government is taking a more direct approach, telling fishermen: If you see this fish, please kill it.

PHOTOS JONATHAN MARSHALL (TOP); DAVID DOUBILET

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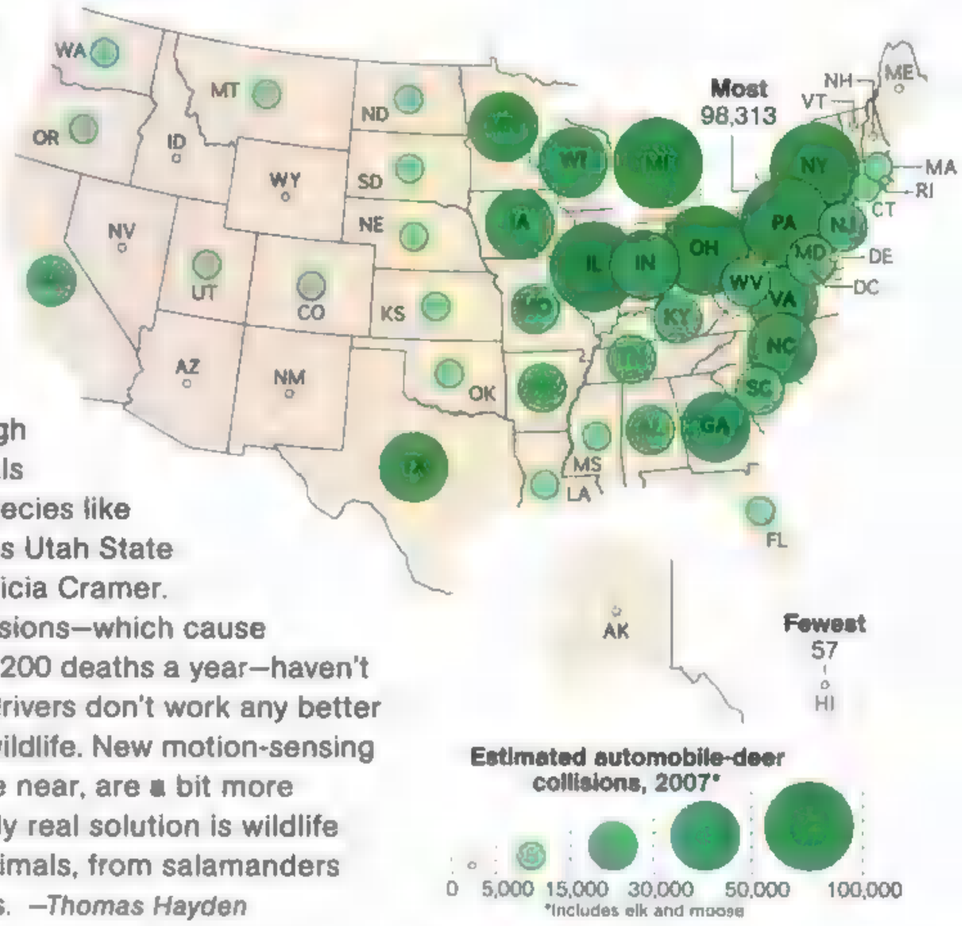
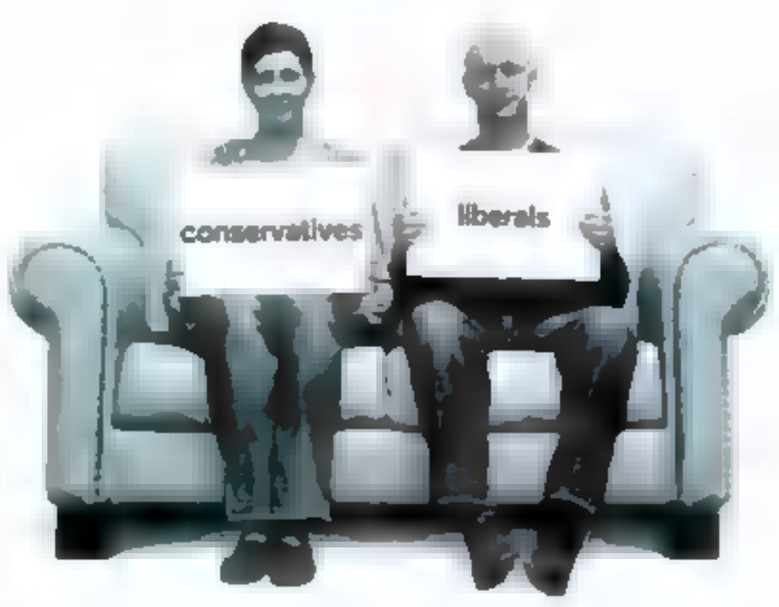
Deer Crashing Urban sprawl and the commuter traffic it generates are taking a deadly toll on America's deer population. One insurance-industry estimate puts annual deer-vehicle collisions at 1.5 million nationwide. A 2007 study, based on accident claims, found deer crashes were up 7 percent. Numbers are especially high in the east, where white-tailed deer are abundant. Although crashes won't wipe out common animals like deer and raccoons, endangered species like the Florida panther are threatened, says Utah State University transportation ecologist Patricia Cramer.

Efforts to reduce the number of collisions—which cause thousands of human injuries and some 200 deaths a year—haven't been very successful. Signs that warn drivers don't work any better than ultrasonic car whistles that warn wildlife. New motion-sensing signs, which flash when big animals are near, are a bit more effective. Some experts believe the only real solution is wildlife overpasses and underpasses to get animals, from salamanders to grizzly bears, safely across the roads. *—Thomas Hayden*



A Pennsylvania dump attests to the state's status as the deadliest place for deer to cross the road.

NGM MAPS. SOURCE: STATE FARM INSURANCE. PHOTO: WILLIAM ALBERT ALLARD



It's American to disagree. It's also American to come together in the face of a challenge. And few challenges are as urgent as global climate change. More than a million people from all walks of life have come together to demand solutions. Now we need you. Take a minute and join us at wecansolveit.org. Together we can solve the climate crisis.

Join us today.

WHERE IN THE WORLD?

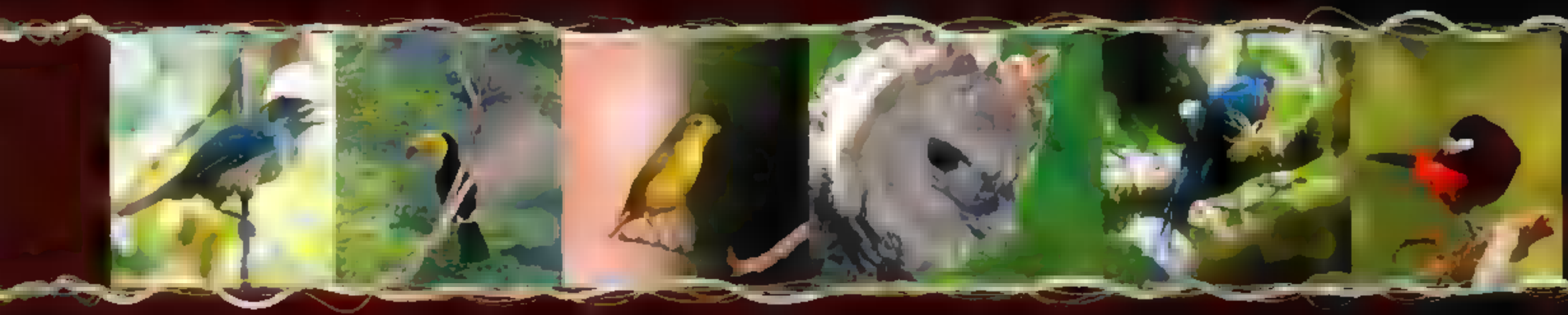
Wind and rain carved spires from nine-million-year-old volcanic deposits in Turkey.

Tuff Terrain Volcanic turrets are brushed by sunlight in central Turkey's Cappadocia region. Once the heart of the Hittite Empire, the area is now known for chiseled views, cave churches and monasteries with frescoes dating back to A.D. 1000, subterranean settlements that once housed thousands, and local wine. Ancient eruptions laid the groundwork, setting down tons of volcanic tuff, or welded ash. Uneven erosion forged the jutting, whitish geography; darker patches are soil cover. The checkerboard patterns are vineyards. Hidden away are old grape-crushing vats built into the rocks and still in use. *—Jennifer S. Holland*

PHOTO: WOLFGANG KAEHLER

"By far the most popular drive-thru of the Americas"
According to 973 spotted bird species.

30,193. sq. miles of rich biodiversity and vast forest.
No wonder it is birds' favorite place to stay in.



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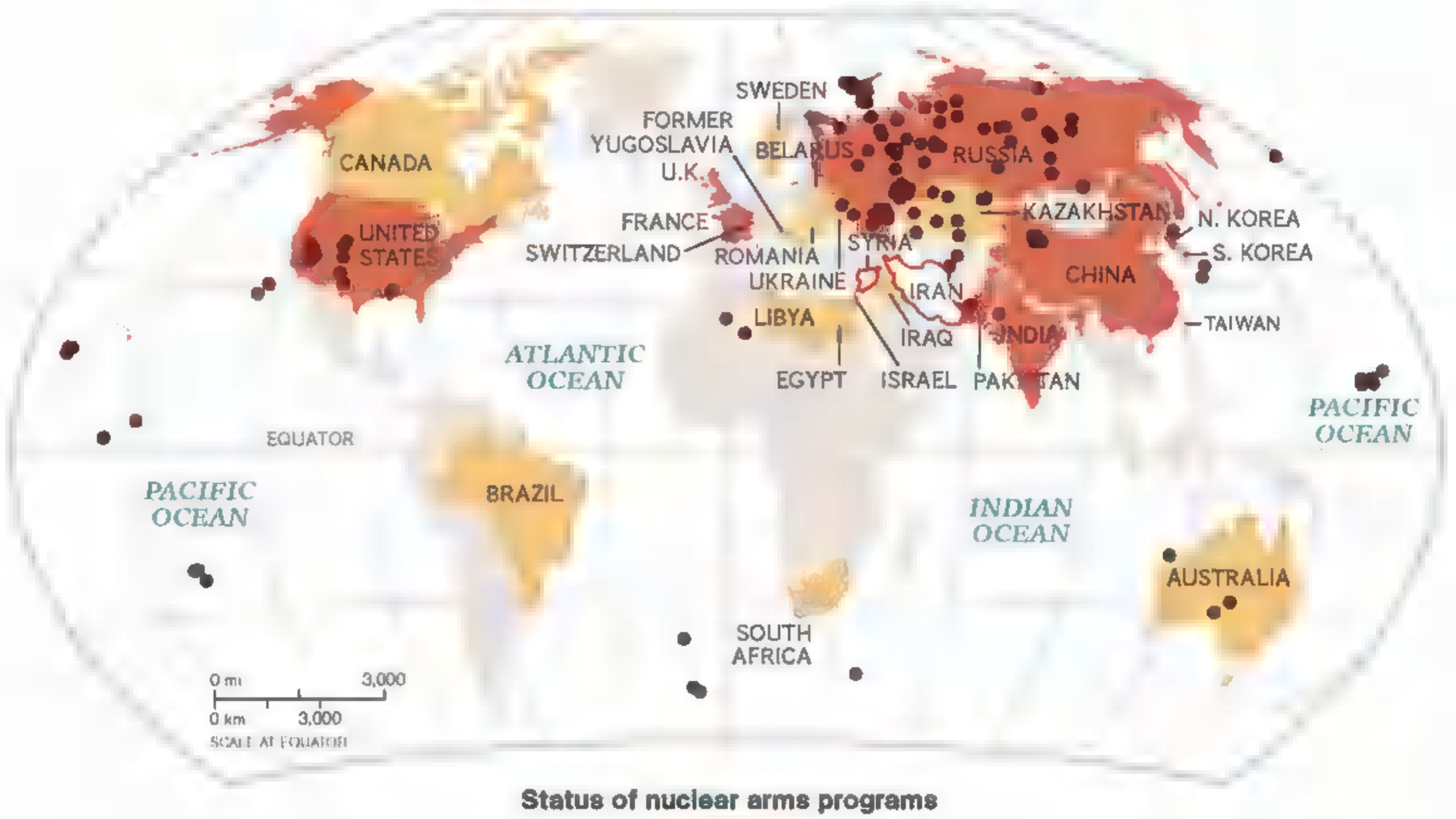
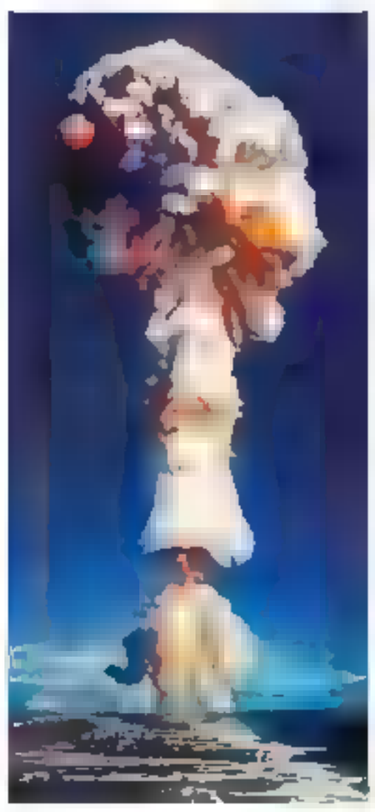
Atomic Age

Since 1945 more nations have opted out of the nuclear arms race than have joined it. But with nuclear technology becoming more widely dispersed, this map remains a work in progress.





A test detonation occurs in French Polynesia in 1968.

Since the first atomic mushroom cloud spread its ominous shadow over a New Mexico desert in 1945, nations have hotly debated and heavily negotiated nuclear weapons testing. Yet several key factors—the end of the Cold War, the relative success of the Comprehensive Nuclear Test Ban Treaty (signed by 178 nations to date), advances such as computer models that allow detonation-free tests—seemed to push such trials to the brink of extinction.

But all is not quiet on the atomic front. The lack of live tests today belies worrisome trends. Former U.S. Senator Sam Nunn, a leading nonproliferation expert, says the spread of nuclear know-how and material—combined with the rise of rogue states and terrorist groups, as well as a wave of nations pursuing nuclear energy programs, which could jump-start weapons production—is moving the world toward a dangerous tipping point. "We are in a race between cooperation and catastrophe," says Nunn. "And the threats are outrunning the response." *—Peter Gwin*

BOOM CENTURY

Over 63 years, a total of 2,065 verified nuclear detonations have occurred—two in wartime, the rest as tests on land, in the air, and underwater.

1,056	U.S.
715	U.S.S.R.
198	France
45	U.K.
45	China
2	India
2	Pakistan
1	N. Korea
1	Unknown

MAP: JEROME COOKSON, NG STAFF. MAP SOURCES: NUCLEAR TEST DATABASE, GEOSCIENCE AUSTRALIA; INSTITUTE FOR SCIENCE AND INTERNATIONAL SECURITY. PHOTO: LA PHOTOTHÈQUE SGM/DIGITAL RAILROAD

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Over the Hump Humans made a good try at exterminating humpback whales. The relatively slow swimmers were easy targets for harpoons. In the 20th century, for example, 95 to 99 percent of the Southern Hemisphere's humpbacks were killed for blubber and meat. Hunting was banned in 1966. The last kills were in 1973, when the Soviet Union ended its huge illegal whaling program. Leaving humpbacks alone worked: This year they moved from "vulnerable" to "least concern" on the international list of threatened species.

Not all humpbacks are swimming pretty. Those in the Arabian Sea, the only ones that don't migrate to polar waters to eat, are now listed as "endangered"—only a few hundred are left. In past Soviet hunts, 242 of them died. But off Australia, where the singing whales used to be pursued for blubber, humpbacks are the stars of whale-watching tours. *—Helen Fields*

PHOTO: FLIP NICKLIN, MINDEN PICTURES

He spent decades researching the right wood
for his wine barrels.

You can taste the results in just a sip.

Robert Mondavi believed that finesse and care were equal ingredients to the grapes themselves. At the time, people thought him a bit obsessive. Which is the very same reason people drink Woodbridge by Robert Mondavi today.

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FOUND!

Silver Dollars of the American Revolution

OWN THE COIN OF AMERICA'S FREEDOM

Larger than actual size of 39 mm

After nine long years, in 1783 American patriots defeated the British soldiers of King George III and won our independence from England. Soon fireworks lit the night sky above town squares and "Yankee Doodle" was sung in the streets. Freedom reigned for a new nation—the United States of America.

Most likely, the victorious Americans bought their flags, fireworks and libations with the most desired currency of the day, Spanish colonial silver dollars of considerable heft and quality. Now, thanks to a recent discovery, you can own that very coin—the Silver Dollar of the American Revolution!

Congress Chose This Silver Dollar As Our First Legal Tender

George Washington, Thomas Jefferson and Ben Franklin recognized that the Spanish Silver Dollar was the most desired coin in colonial America. Jefferson recommended the Continental Congress adopt it as our nation's first monetary standard of value. The Congress agreed, and the rest is history…tangible history that you can now own at an amazingly affordable price.

America's History in the Palm of Your Hand

Imagine the kind of historic significance this coin represents. A typical craftsman during the Revolutionary War-era earned about ten of these Silver Dollars in a month, using them in the shops, markets and taverns. Imagine the huge spending power of these coins compared to today's paper money!

Lost Treasure of Massive Silver Dollars

Each of these heavy silver dollars weighs over 416 grains of .903 fine silver. With the price of silver recently soaring past $20 per ounce, the silver value alone is an important consideration. Each of these Silver Dollars was recovered from a colonial-era galleon lost off the American coast, which adds luster to its value as a collector's item.

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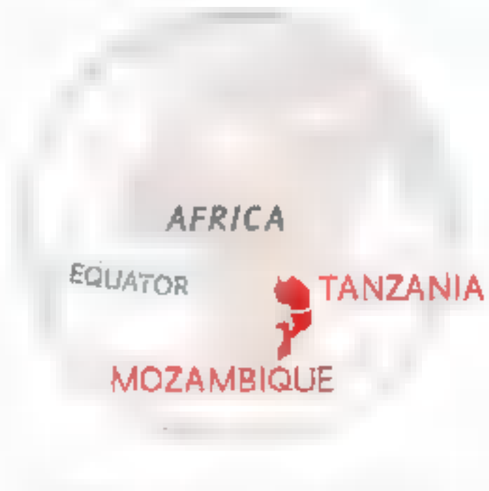
Ratted Out Some people cringe when they see a rat, but Bart Weetjens smiles. A Belgian product designer, Weetjens devised a way for these often reviled rodents to help solve a global problem: how to locate land mines, some 60 million of which are scattered in 69 countries. Dogs are often deployed to sniff them out, "but I knew rats were easier to train," says Weetjens, who bred them as a boy. Rats are also light, so they don't detonate the mines they find; they stay healthy in tropical areas, where many explosives are buried; and they're cheap to breed and raise. In the late 1990s Weetjens chose the African giant pouched rat, with its very sensitive nose, for Pavlovian training: If the rats scratched the ground when they sniffed TNT, they got a reward.

More than 30 trained sniffer rats, aka HeroRATS, have started sweeping minefields in Mozambique, where they've cleared almost a quarter square mile. Weetjens also trains rats to screen human saliva for tuberculosis and is mulling new missions, such as finding earthquake victims buried in rubble. Lives saved, health improved, mines defused—nothing to cringe about here. *—Alan Mairson*



Scent on a mission HeroRATS are active in Tanzania and Mozambique. Africa is the world's most mine-riddled continent.

Sargon, an African giant pouched rat, sniffs out explosives in a field in Mozambique.

PHOTOS: XAVIER ROSSI (ABOVE); ALISON WRIGHT, CORBIS (TOP). NGM MAPS

Eurasia was theirs alone for 200,000 years. Then the newcomers arrived.

Last of the Neanderthals

Reconstruction by Kennis & Kennis
Reconstruction photographs by Joe McNally

For the first time, a Neanderthal female peers from the past in a reconstruction informed by both fossil anatomy and ancient DNA. At least some of her kind carried a gene for red hair and pale skin.

A Hunter Retreats

With their large brains and enormous strength, Neanderthals seemed equipped to face any obstacle. But as the climate changed and a new kind of human appeared on the landscape, their dwindling numbers sought refuge in the highlands.

The heights of northern Spain suggest the demanding environment that confronted many Neanderthals late in their reign. The model grips a spear to signify that females may have hunted with males.

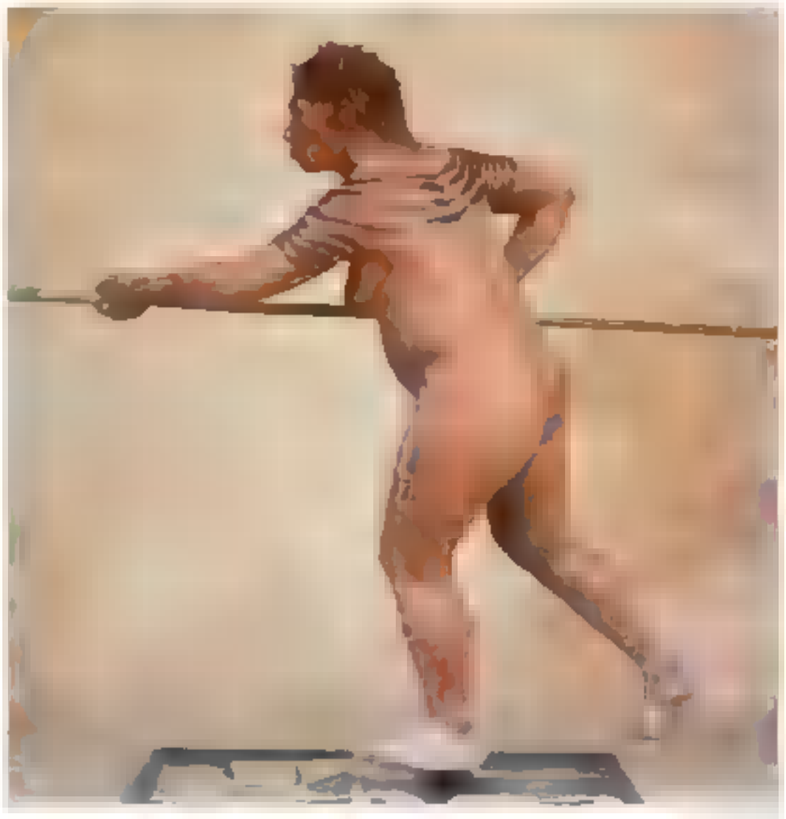
WITH PERMISSION OF NATIONAL PARKS OF EUROPE'S MOUNTAINPEAKS

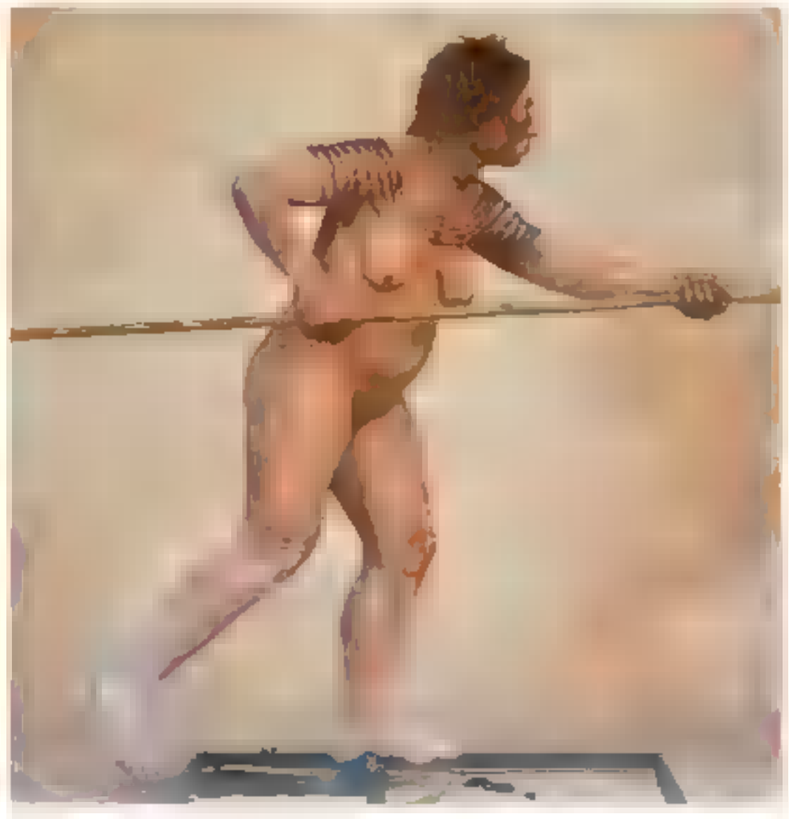
By Stephen S. Hall
Photographs by David Liittschwager

In March of 1994 some spelunkers exploring an extensive cave system in northern Spain poked their lights into a small side gallery and noticed two human mandibles jutting out of the sandy soil. The cave, called El Sidrón, lay in the midst of a remote upland forest of chestnut and oak trees in the province of Asturias, just south of the Bay of Biscay. Suspecting that the jawbones might date back as far as the Spanish Civil War, when Republican partisans used El Sidrón to hide from Franco's soldiers, the cavers immediately notified the local Guardia Civil. But when police investigators inspected the gallery, they discovered the remains of a much larger—and, it would turn out, much older—tragedy.

Within days, law enforcement officials had shoveled out some 140 bones, and a local judge ordered the remains sent to the national forensic pathology institute in Madrid. By the time scientists finished their analysis (it took the better part of six years), Spain had its earliest cold case. The bones from El Sidrón were not Republican soldiers, but the fossilized remains of a group of Neanderthals who lived, and perhaps died violently, approximately 43,000 years ago. The locale places them at one of the most important geographical intersections of prehistory, and the date puts them squarely at the center of one of the most enduring mysteries in all of human evolution.

The Neanderthals, our closest prehistoric relatives, dominated Eurasia for the better part of 200,000 years. During that time, they poked their famously large and protruding noses into every corner of Europe, and beyond—south along the Mediterranean from the Strait of Gibraltar to Greece and Iraq, north to Russia, as far west as Britain, and almost to Mongolia in the east. Scientists estimate that even at the height of the Neanderthal occupation of western Europe, their total number probably never exceeded 15,000. Yet they managed to endure,





even when a cooling climate turned much of their territory into something like northern Scandinavia today—a frigid, barren tundra, its bleak horizon broken by a few scraggly trees and just enough lichen to keep the reindeer happy.

By the time of the tragedy at El Sidrón, however, the Neanderthals were on the run, seemingly pinned down in Iberia, pockets of central Europe, and along the southern Mediterranean by a deteriorating climate, and further squeezed by the westward spread of anatomically modern humans as they emerged from Africa into the Middle East and beyond. Within another 15,000 years or so, the Neanderthals were gone forever, leaving behind a few bones and a lot of questions. Were they a clever and perseverant breed of survivors, much like us, or a cognitively challenged dead end? What happened during that period, roughly 45,000 to 30,000 years ago, when the Neanderthals shared some parts of the Eurasian landscape with those modern human migrants from Africa? Why did one kind of human being survive, and the other disappear?

On a damp, fog-shrouded morning in September 2007, I stood before the entrance to El Sidrón with Antonio Rosas of the National Museum of Natural Sciences in Madrid, who heads the paleoanthropological investigation. One of his colleagues handed me a flashlight, and I gingerly lowered myself into the black hole. As my eyes adjusted to the interior, I began to make out the fantastic contours of a karstic cave. An underground river had hollowed out a deep vein of sandstone, leaving behind a limestone cavern extending hundreds of yards, with side galleries spidering out to at least 12 entrances. Ten minutes into the cave, I arrived at the Galería del Osario—the "tunnel of bones." Since 2000, some 1,500 bone fragments have been unearthed from this side gallery, representing the remains of at least nine Neanderthals—five young adults, two adolescents, a child of about eight, and a three-year-old toddler. All showed signs of nutritional stress in their teeth—not unusual in young

CREATING A NEANDERTHAL To reconstruct a five-foot-tall, heavily muscled woman, artists Adrie and Alfons Kennis built a skeleton using replicas of a pelvis and cranial anatomy from Neanderthal females combined with parts from a composite skeleton of a male from the American Museum of Natural History in New York. Paleoanthropologist Steve Churchill of Duke University made calculations to reduce male bone sizes to female dimensions. Since summers would have been warm even during glacial periods, Neanderthals probably would have gone naked to shed heat from their stocky bodies. Lumps of pigments found at Neanderthal sites inspired the artists to add decorative body art.

Neanderthals late in their time on Earth. But a deeper desperation is etched in their bones. Rosas picked up a recently unearthed fragment of a skull and another of a long bone of an arm, both with jagged edges.

"These fractures were—*clop*—made by humans," Rosas said, imitating the blow of a stone tool. "It means these fellows went after the brains and into long bones for the marrow."

In addition to the fractures, cut marks left on the bones by stone tools clearly indicate that the individuals were cannibalized. Whoever ate their flesh, and for whatever reason—starvation? ritual?—the subsequent fate of their remains bestowed upon them a distinct and marvelous kind of immortality. Shortly after the nine individuals died—possibly within days—the ground below them suddenly collapsed, leaving little time for hyenas and other scavengers to scatter the remains. A slurry of bones, sediment, and rocks tumbled 60 feet into a hollow limestone chamber below, much as mud fills the inside walls of a house during a flood.

There, buffered by sand and clay, preserved by the cave's constant temperature, and sequestered in their jewel cases of mineralized bone, a few precious molecules of the Neanderthals' genetic code survived, awaiting a time in the distant future when they could be plucked out, pieced together, and examined for clues to how these people lived, and why they vanished.

THE FIRST CLUE that our kind of human was not the first to inhabit Europe turned up a century and a half ago, about eight miles east of Düsseldorf, Germany. In August 1856 laborers quarrying limestone from a cave in the Neander Valley dug out a beetle-browed skullcap and some thick limb bones. Right from the start, the Neanderthals were saddled with an enduring cultural stereotype as dim-witted, brutish cavemen. The size and shape of the fossils does suggest a short, stout fireplug of a physique (males averaged about five feet, five inches tall and about 185 pounds), with massive muscles and a flaring rib cage presumably encasing capacious lungs. Steven E. Churchill, a paleoanthropologist at Duke University, has calculated that to support his body mass in a cold climate, a typical Neanderthal male would have needed up to 5,000 calories daily, or approaching what a bicyclist burns each day in the Tour de France. Yet behind its bulging browridges, a Neanderthal's low-domed skull housed a brain with a volume slightly larger on average than our own today. And while their tools and weapons were more primitive than those of the modern humans who supplanted them in Europe, they were no less sophisticated than the implements made by their modern human contemporaries living in Africa and the Middle East.

Stephen S. Hall's next book is about the natural history of wisdom. This is David Liittschwager's fourth assignment for National Geographic.

PRECIOUS FOSSIL Suited up to avoid contaminating her find, researcher Araceli Soto Flórez bags a Neanderthal bone from El Sidrón cave in Spain. Fossils uncovered here have yielded faint traces of ancient DNA. Genetic analysis provides evidence for red hair, and perhaps ■ capacity for speech.

One of the longest and most heated controversies in human evolution rages around the genetic relationship between Neanderthals and their European successors. Did the modern humans sweeping out of Africa beginning some 60,000 years ago completely replace the Neanderthals, or did they interbreed with them? In 1997 the latter hypothesis was dealt a powerful blow by geneticist Svante Pääbo—then at the University of Munich—who used an arm bone from the original Neanderthal man to deliver it. Pääbo and his colleagues were able to extract a tiny 378-letter snippet of mitochondrial DNA (a kind of short genetic appendix to the main text in each cell) from the 40,000-year-old specimen. When they read out the letters of the code, they found that the specimen's DNA differed from living humans to a degree suggesting that the Neanderthal and modern human lineages had begun to diverge long before the modern human migration out of Africa. Thus the two represent separate geographic and evolutionary branches splitting from a common ancestor. "North of the Mediterranean, this lineage became Neanderthals," said Chris Stringer, research leader on human origins at the Natural History Museum

in London, "and south of the Mediterranean, it became us." If there was any interbreeding when they encountered each other later, it was too rare to leave a trace of Neanderthal mitochondrial DNA in the cells of living people.

Pääbo's genetic bombshell seemed to confirm that Neanderthals were a separate species—but it does nothing to solve the mystery of why they vanished, and our species survived.

One obvious possibility is that modern humans were simply more clever, more sophisticated, more "human." Until recently, archaeologists pointed to a "great leap forward" around 40,000 years ago in Europe, when the Neanderthals' relatively humdrum stone tool industry—called Mousterian, after the site of Le Moustier in southwestern France—gave way to the more varied stone and bone tool kits, body ornaments, and other signs of symbolic expression associated with the appearance of modern humans.

Were they a clever and perseverant breed of survivors, much like us, or a cognitively challenged dead end?

Some scientists, such as Stanford University anthropologist Richard Klein, still argue for some dramatic genetic change in the brain—possibly associated with a development in language—that propelled early modern humans to cultural dominance at the expense of their beetle-browed forebears.

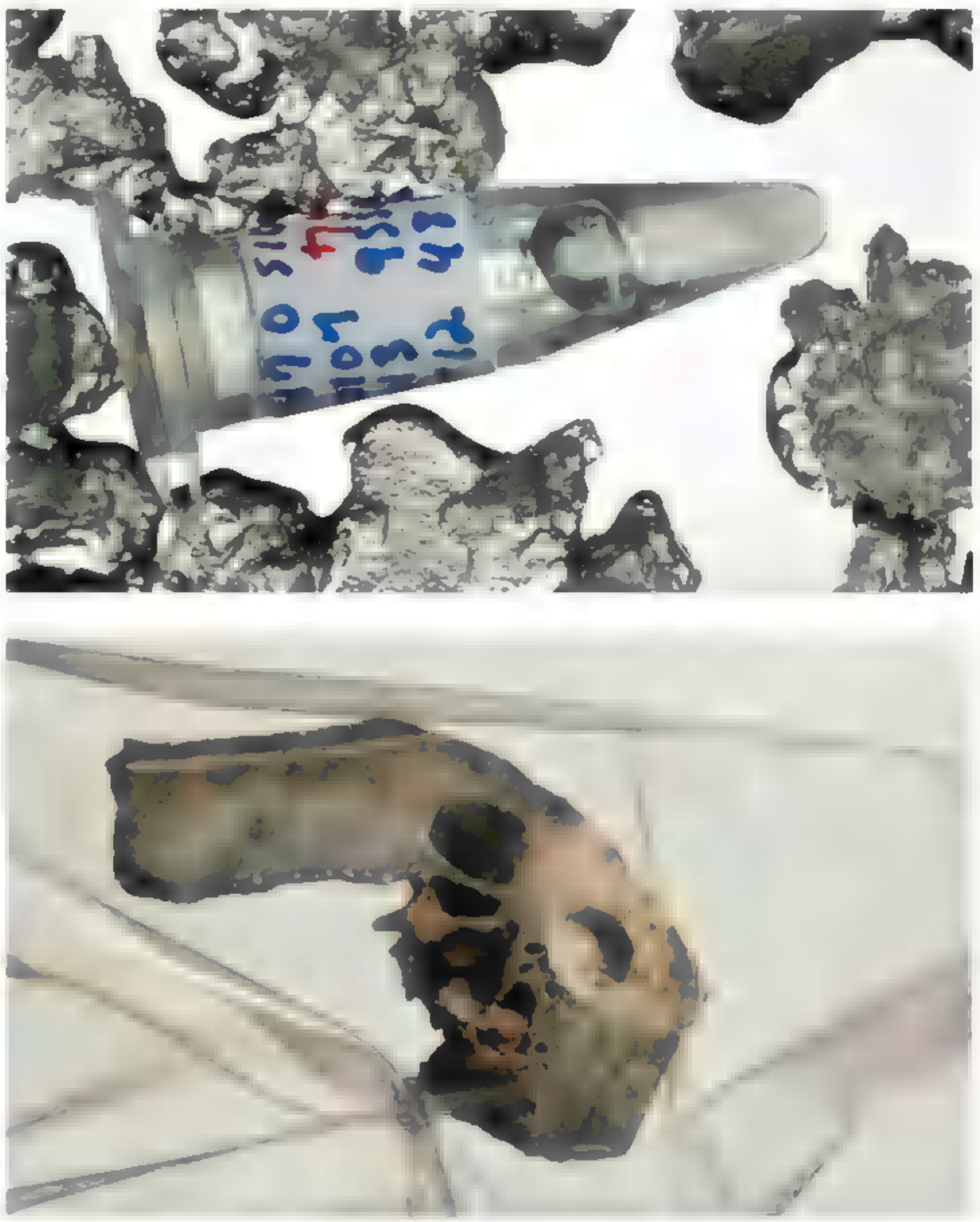
But the evidence in the ground is not so cut and dried. In 1979 archaeologists discovered a late Neanderthal skeleton at Saint-Césaire in southwestern France surrounded not with typical Mousterian implements, but with a surprisingly modern repertoire of tools. In 1996 Jean-Jacques Hublin of the Max Planck Institute in Leipzig and Fred Spoor of University College London identified a Neanderthal bone in another French cave, near Arcy-sur-Cure, in a layer of sediment also containing ornamental objects previously associated only with modern humans, such as pierced animal teeth and ivory rings. Some scientists, such as British paleoanthropologist Paul Mellars, dismiss such modern "accessorizing" of a fundamentally archaic lifestyle as an "improbable coincidence"—a last gasp of imitative behavior by Neanderthals before the inventive newcomers out of Africa replaced them. But more recently, Francesco d'Errico of the University of Bordeaux and Marie Soressi, also at the Max Planck Institute in Leipzig, analyzed hundreds of crayon-like blocks of manganese dioxide from a French cave called Pech de l'Azé, where Neanderthals lived well before modern humans arrived in Europe. D'Errico and Soressi argue that the Neanderthals used the black pigment for body decoration, demonstrating that they were fully capable of achieving "behavioral modernity" all on their own.

"At the time of the biological transition," says Erik Trinkaus, a paleoanthropologist at Washington University in St. Louis, "the basic behavior [of the two groups] is pretty much the same, and any differences are likely to have been subtle."

Trinkaus believes they indeed may have mated occasionally. He sees evidence of admixture between Neanderthals and modern humans in certain fossils, such as a 24,500-year-old skeleton of a young child discovered at the Portuguese site of Lagar Velho, and a 32,000-year-old skull from a cave called Muierii in Romania. "There were very few people on the landscape, and you need to find a mate and reproduce," says Trinkaus. "Why not? Humans are not known to be choosy. Sex happens."

It may have happened, other researchers say, but not often, and not in a way that left behind any evidence. Katerina Harvati, another researcher at the Max Planck Institute in Leipzig, has used detailed 3-D measurements of Neanderthal and early modern human fossils to predict exactly what hybrids between the two would have looked like. None of the fossils examined so far matches her predictions.

The disagreement between Trinkaus and Harvati is hardly the first time that two respected paleoanthropologists have looked at the same set of bones and come up with mutually contradictory interpretations. Pondering—and debating—the meaning of fossil anatomy will always play a role in understanding Neanderthals. But now there are other ways to bring them back to life.



GENETIC ESSENCE Taking DNA from a 38,000-year-old leg bone fragment (bottom) found in Croatia, scientists are spelling out the complete Neanderthal genetic code. Results from the sample (top, on ice) suggest that Neanderthals and modern humans are separate species, but do not rule out some interbreeding.

TWO DAYS AFTER my first descent into El Sidrón cave, Araceli Soto Flórez, a graduate student at the University of Oviedo, came across a fresh Neanderthal bone, probably a fragment of a femur. All digging immediately ceased, and most of the crew evacuated the chamber. Soto Flórez then squeezed herself into a sterile jumpsuit, gloves, booties, and plastic face mask. Under the watchful eyes of Antonio Rosas and molecular biologist Carles Lalueza-Fox, she delicately extracted the bone from the soil, placed it in a sterile plastic bag, and deposited the bag in a chest of ice. After a brief stop in a hotel freezer in nearby Villamayo, the leg bone eventually arrived at Lalueza-Fox's laboratory at the Institute of Evolutionary Biology in Barcelona. His interest was not in the anatomy of the leg or anything it might reveal about Neanderthal locomotion. All he wanted from it was its DNA.

Prehistoric cannibalism has been very good for modern-day molecular biology. Scraping flesh from a bone also removes the DNA of microorganisms that might otherwise contaminate the sample. The bones of El Sidrón have not yielded the most DNA of any Neanderthal fossil—that honor belongs to a specimen from Croatia, also cannibalized—but so far they have revealed the most compelling insights

WITH PERMISSION OF 454 LIFE SCIENCES, A ROCHE COMPANY, BRANFORD, CT (TOP) AND MAX PLANCK INSTITUTE FOR EVOLUTIONARY ANTHROPOLOGY (MPI), LEIPZIG, GERMANY (TOP AND BOTTOM)

Side by Side With Neanderthals

When our ancestors emerged from Africa into Eurasia around 45,000 years ago, they found the landscape already inhabited. Neanderthals were 99.5 percent genetically identical to modern humans, but had evolved distinctive anatomy during hundreds of thousands of years in the cold Eurasian climate.

NEANDERTHAL FEATURES

New genetic evidence

A form of the gene *MC1R* would have endowed its carriers with red hair and pale skin.

Large browridges combined with a receding forehead gave Neanderthals a beetle-browed look.

MODERN HUMAN FEMALE

Neanderthal faces projected farther forward in the middle than those of modern humans.

Neanderthals carried a version of the *FOXP2* gene, associated with language ability.

Neanderthal mandibles lacked chins.

Robust Bodies Adapted to the Cold

NEANDERTHAL SKELETON

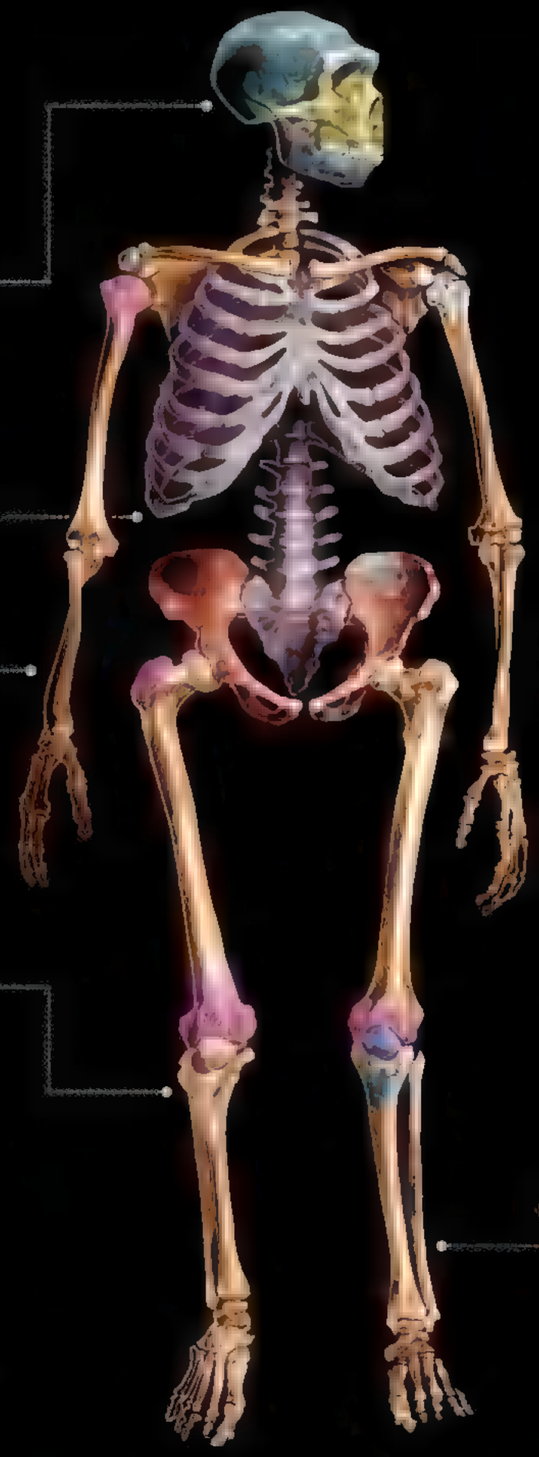
Neanderthal skulls were long and low, but held brains slightly larger on average than those of living humans.

Wide bodies conserved heat in cold climates, while large, conical rib cages housed big lungs needed for high levels of activity.

Sturdy, heavily muscled limb bones evolved in response to a demanding lifestyle.

Large muscles positioned to maximize leverage resulted in exceptional strength.

Short limbs helped reduce surface area to retain body heat.



RECONSTRUCTION

The female Neanderthal illustrated in this story was created by assembling casts of fossil bones from several individuals, including rescaled male specimens.

- SPY 1 (BELGIUM)
- GIBRALTAR (U.K.)
- LA FERRASSIE 1 (FRANCE)
- KEBARA 2 (ISRAEL)
- TABUN 1 (ISRAEL) THE PELVIS PORTION ON THE LEFT WAS CREATED BY MIRRORING THE EXISTING FOSSIL ON THE RIGHT
- FELDHOFER (NEANDER VALLEY, GERMANY)
- LA CHAPELLE-AUX-SAINTS (FRANCE)
- RECONSTRUCTED FROM MODERN HUMANS

DAILY CALORIC NEEDS

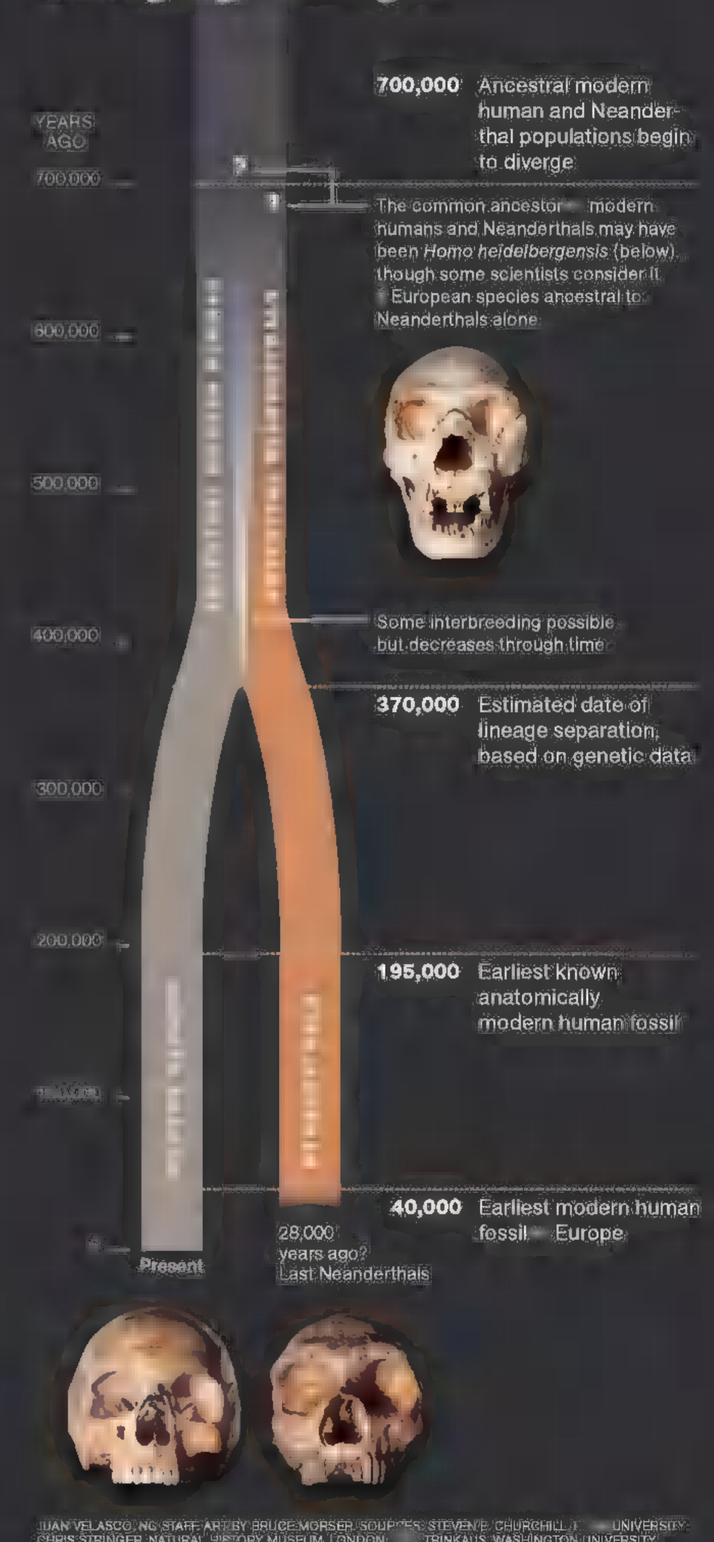
2,200 cal/day

** USDA recommendation for female of average size (5'4" tall, 138 pounds) who engages in light-to-moderate activity*

4,034 cal/day

Neanderthal female of average size (5'2" tall, 146 pounds)

Diverging Lineages



700,000 Ancestral modern human and Neanderthal populations begin to diverge

The common ancestor of modern humans and Neanderthals may have been *Homo heidelbergensis* (below), though some scientists consider it a European species ancestral to Neanderthals alone.

Some interbreeding possible but decreases through time

370,000 Estimated date of lineage separation, based on genetic data

195,000 Earliest known anatomically modern human fossil

40,000 Earliest modern human fossil in Europe

28,000 years ago? Last Neanderthals

JUAN VELASCO, NG STAFF; ART BY BRUCE MORSER. SOURCES: STEVEN E. CHURCHILL, DUKE UNIVERSITY; CHRIS STRINGER, NATURAL HISTORY MUSEUM, LONDON; TRINKAUS, WASHINGTON UNIVERSITY IN ST. LOUIS; BONE CLONES, KOMAREK SKULLS PHOTOGRAPHED AT: BURGOS MUSEUM (TOP); NATURAL HISTORY MUSEUM, LONDON (BOTTOM, BOTH)

Even in females, such as this skull from Gibraltar, browridges were large, arching over each orbit and continuing across the midface.

Most adults had heavily worn front teeth, probably from using them as a "third hand" to grip hides and other objects while working on them with tools.

Neanderthal braincases were not high-domed like ours, but rather had a low, rounded contour, more apparent when viewed from behind.

Large external nasal dimensions, long thought to warm incoming air in cold climates, are more likely a trait inherited from ancestors.

Large nasal sinuses adjacent to the nose gave the Neanderthal upper jaws and cheeks an inflated appearance.

NEANDERTHAL SKULL

MODERN HUMAN SKULL

Marina Allende, from a farm near El Sidrón, where Neanderthals once roamed, displays how a modern European woman sizes [illegible] next to th[illegible] thicker Neanderthal physique. Nea[illegible] robes were [illegible], crude as [illegible] of sewing tools.

into Neanderthal appearance and behavior. In October 2007 Lalueza-Fox, Holger Römpler of the University of Leipzig, and their colleagues announced that they had isolated a pigmentation gene from the DNA of an individual at El Sidrón (as well as another Neanderthal fossil from Italy). The particular form of the gene, called *MC1R*, indicated that at least some Neanderthals would have had red hair, pale skin, and, possibly, freckles. The gene is unlike that of red-haired people today, however—suggesting that Neanderthals and modern humans developed the trait independently, perhaps under similar pressures in northern latitudes to evolve fair skin to let in more sunlight for the manufacture of vitamin D. Just a few weeks earlier, Svante Pääbo, who now heads the genetics laboratory at the Max Planck Institute in Leipzig, Lalueza-Fox, and their colleagues had announced an even more astonishing find: Two El Sidrón individuals appeared to share, with modern humans, a version of a gene called *FOXP2* that contributes to speech and language ability, acting not only in the brain but also on the nerves that control facial muscles. Whether Neanderthals were capable of sophisticated language abilities or a more primitive form of vocal communication (singing, for example) still remains unclear, but the new genetic findings suggest they possessed some of the same vocalizing hardware as modern humans.

Behind its bulging browridges, a Neanderthal's skull housed a brain slightly larger on average than our own today.

All this from a group of ill-fated Neanderthals buried in a cave collapse, soon after they were consumed by their own kind.

"So maybe it's a good thing to eat your conspecifics," says Pääbo.

A tall, cheerful Swede, Pääbo is the main engine behind a breathtaking scientific tour de force: the attempt, expected to be completed next month, to read out not just single Neanderthal genes, but the entire three-billion-letter sequence of the Neanderthal genome. Traces of DNA in fossils are vanishingly faint, and because Neanderthal DNA is ever so close to that of living people, one of the biggest hurdles in sequencing it is the ever present threat of contamination by modern human DNA—especially by the scientists handling the specimens. The precautions taken in excavating at El Sidrón are now becoming standard practice at other Neanderthal sites. Most of the DNA for Pääbo's genome project, however, has come from the Croatian specimen, a 38,000-year-old fragment of leg bone found almost 30 years ago in the Vindija cave. Originally deemed unimportant, it sat in a drawer in Zagreb, largely untouched and thus uncontaminated, for most of its museum life.

Now it is the equivalent of a gold mine for prehistoric human DNA, albeit an extremely difficult mine to work. After the DNA is extracted in a sterile laboratory in the basement of the Max Planck Institute, it is shipped overnight to Branford, Connecticut, where collaborators at 454 Life Sciences have invented machines that can rapidly decipher the sequence of DNA's chemical letters. The vast majority of those letters spell out bacterial contaminants or other non-Neanderthal genetic information. But in the fall of 2006, Pääbo and his colleagues announced they had deciphered approximately one million letters of Neanderthal DNA. (At the same time, a second group, headed by Edward Rubin at the Department of Energy Joint Genome Institute in Walnut Creek, California, used DNA provided by Pääbo to read out snippets of genetic code using a different approach.) By last year, dogged by claims that their work had serious contamination problems, the Leipzig group claimed to have improved accuracy and identified about 70 million letters of DNA—roughly 2 percent of the total.

"We know that the human and chimpanzee sequences are 98.7 percent the same, and Neanderthals are much closer to us than chimps," said Ed Green, head of biomathematics in Pääbo's group in Leipzig, "so the reality is that for most of the sequence, there's no difference between Neanderthals and [modern] humans." But the differences—less than a half percent of the sequence—are enough to confirm that

Rise and Fall of Neanderthals

Recent genetic evidence reveals that Neanderthals occupied a wider swath of territory than previously thought, settling as far east as Siberia (top). Some 45,000 years ago, anatomically modern humans from Africa migrated into Eurasia (bottom). Climate swings and competition with the newcomers may have combined to push Neanderthals into a few outposts before they went extinct.

Neanderthal range
Modern human range
Neanderthal site
Modern human site
Neanderthal and modern human site (occupied independently)
0 mi 400
0 km 400

250,000–45,000 years ago
Neanderthals before the arrival of modern humans in Eurasia

45,000–28,000 years ago
Period of Neanderthal and modern human overlap in Eurasia

CHARLES BERRY AND LISA R. RITTER, NG STAFF
SOURCES: WILLIAM DAVIES, UNIVERSITY OF SOUTHAMPTON; CLIVE FINLAYSON, GIBRALTAR MUSEUM; CHRIS STRINGER, NATURAL HISTORY MUSEUM, LONDON

the two lineages had begun to diverge around 700,000 years ago. The Leipzig group also managed to extract mitochondrial DNA from two fossils of uncertain origin that had been excavated in Uzbekistan and southern Siberia; both had a uniquely Neanderthal genetic signature. While the Uzbekistan specimen, a young boy, had long been considered a Neanderthal, the Siberian specimen was a huge surprise, extending the known Neanderthal range some 1,200 miles east of their European stronghold.

So, while the new genetic evidence appears to confirm that Neanderthals were a separate species from us, it also suggests that they may have possessed human language and were successful over a far larger sweep of Eurasia than previously thought. Which brings us back to the same hauntingly persistent question that has shadowed them from the beginning: Why did they disappear?

Their bodies' relentless demand for calories probably forced Neanderthal women and children to join in the hunt.

TO COAX A NEANDERTHAL FOSSIL to reveal its secrets, you can measure it with calipers, probe it with a CT scan, or try to capture the ghost of its genetic code. Or if you happen to have at your disposal a type of particle accelerator called a synchrotron, you can put it in a lead-lined room and blast it with a 50,000-volt x-ray beam, without disturbing so much as a single molecule.

Over a sleep-deprived week in October 2007, a team of scientists gathered at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, for an unprecedented "convention of jawbones." The goal was to explore a crucial question in the life history of the Neanderthals: Did they reach maturity at an earlier age than their modern human counterparts? If so, it might have implications for their brain development, which in turn might help explain why they disappeared. The place to look for answers was deep inside the structure of Neanderthal teeth.

"When I was young, I thought that teeth were not so useful in assessing recent human evolution, but now I think they are the most important thing," said Jean-Jacques Hublin, who had accompanied his Max Planck Institute colleague Tanya Smith to Grenoble.

Along with Paul Tafforeau of the ESRF, Hublin and Smith were squeezed into a computer-filled hutch at the facility—one of the three largest synchrotrons in the world, with a storage ring for energized electrons half a mile in circumference—watching on a video monitor as the x-ray beam zipped through the right upper canine of an adolescent Neanderthal from the site of Le Moustier in southwestern France, creating arguably the most detailed dental x-ray in human history. Meanwhile, a dream team of other fossils sat on a shelf nearby, awaiting their turn in the synchrotron's spotlight: two jawbones of Neanderthal juveniles recovered in Krapina, Croatia, dating back 130,000 to 120,000 years; the so-called La Quina skull from a Neanderthal youth, discovered in France and dating from between 75,000 to 40,000 years ago; and two striking 90,000-year-old modern human specimens, teeth intact, found in a rock shelter called Qafzeh in Israel.

When teeth are imaged at high resolution, they reveal a complex, three-dimensional hatch of daily and longer periodic growth lines, like tree rings, along with stress lines that encode key moments in an individual's life history. The trauma of birth etches a sharp neonatal stress line on the enamel; the time of weaning and episodes of nutritional deprivation or other environmental stresses similarly leave distinct marks on developing teeth. "Teeth preserve a continuous, permanent record of growth, from before birth until they finish growing at the end of adolescence," Smith explained. Human beings take longer to reach puberty than chimpanzees, our nearest living relatives—which means more time spent learning and developing within the context of the social group. Early hominin species that lived on the savanna in Africa millions of years ago matured fast, more like chimps. So when in evolution did the longer modern pattern begin?

To address this question, Smith, Tafforeau, and colleagues had previously used the synchrotron to demonstrate that an early modern

EVOLVING TOOL KIT With edges both sharp and durable, a heavy, well-used flint tool (left) probably served its Neanderthal owner as both a hide scraper and the point of a thrusting spear. Neanderthals advanced the art of toolmaking with their method of preparing carefully shaped stone cores, from which they flaked off pieces of size and weight suitable for diverse tools. Lacking projectile weapons, however, they had to engage large prey at close quarters. Modern humans brought lighter, more specialized tools to Europe—including narrow flint blades (right) that could have been hafted to a throwing spear, making hunting more efficient and less dangerous.

human child from a site called Jebel Irhoud in Morocco (dated to around 160,000 years ago) showed the modern human life history pattern. In contrast, the "growth rings" in the 100,000-year-old tooth of a young Neanderthal discovered in the Scladina cave in Belgium indicated that the child was eight years old when it died and appeared to be on track to reach puberty several years sooner than the average for modern humans. Another research team, using a single Neanderthal tooth, had found no such difference between its growth pattern and that of living humans. But while a full analysis from the "jawbone convention" would take time, preliminary results, Smith said, were "consistent with what we see in Scladina."

"This would certainly affect Neanderthal social organization, mating strategy, and parenting behavior," says Hublin. "Imagine a society where individuals start to reproduce four years earlier than in modern humans. It's a very different society. It could also mean the Neanderthals' cognitive abilities may have been different from modern humans.'"

Neanderthal society may have differed in another way crucial to group survival: what archaeologists call cultural buffering. A buffer is something in a group's behavior—a technology, a form of social organization, a cultural tradition—that hedges its bets in the high-stakes game of natural selection. It's like having a small cache of extra chips at your elbow in a poker game, so you don't have to fold your hand quite as soon. For example, Mary Stiner and Steven Kuhn of the University of Arizona argue that early modern humans emerged from Africa with the buffer of an economically efficient approach to hunting and gathering that resulted in a more diverse diet. While men chased after large animals, women and children foraged for small game and plant foods. Stiner and Kuhn maintain that Neanderthals did not enjoy the benefits of such a marked division of labor. From southern Israel to northern Germany, the archaeological record shows that Neanderthals instead relied almost entirely on hunting big and medium-size mammals like horses, deer, bison, and wild cattle. No doubt they were eating some vegetable material and even shellfish near the Mediterranean, but the lack of milling stones or other evidence for processing plant foods suggests to Stiner and Kuhn that to a Neanderthal vegetables were supplementary foods, "more like salads, snacks, and desserts than energy-rich staple foods."

Their bodies' relentless demand for calories, especially in higher latitudes and during colder interludes, probably forced Neanderthal women and children to join in the hunt—a "rough and

PHOTOGRAPHED AT NATURAL HISTORY MUSEUM, LONDON (BOTH)

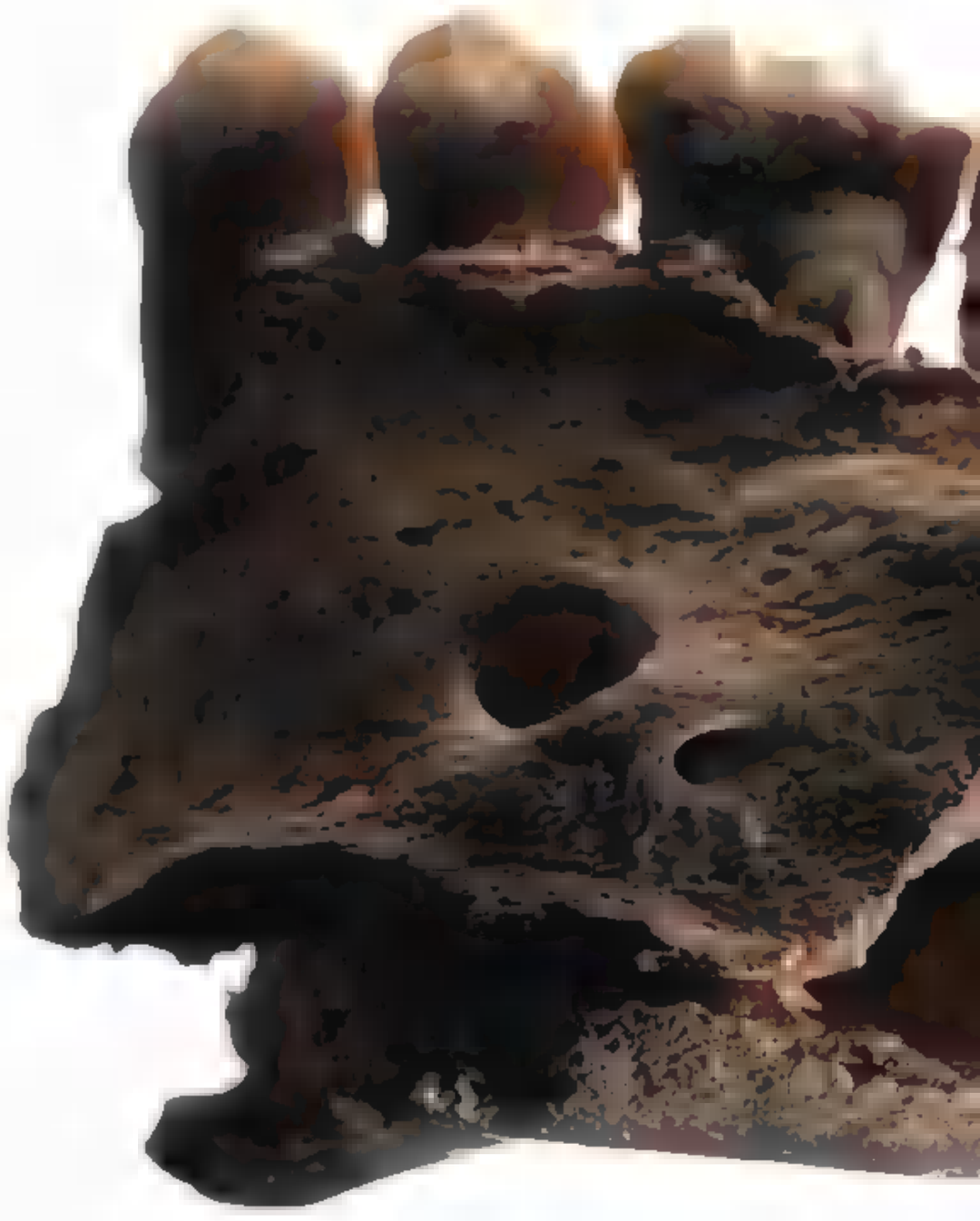
dangerous business," write Stiner and Kuhn, judging by the many healed fractures evident on Neanderthal upper limbs and skulls. The modern human bands that arrived on the landscape toward the end of the Neanderthals' time had other options.

"By diversifying diet and having personnel who [did different tasks], you have a formula for spreading risk, and that is ultimately good news for pregnant women and for kids," Stiner told me. "So if one thing falls through, there's something else." A Neanderthal woman would have been powerful and resilient. But without such cultural buffering, she and her young would have been at a disadvantage.

Of all possible cultural buffers, perhaps the most important was the cushion of society itself. According to Erik Trinkaus, a Neanderthal social unit would have been about the size of an extended family. But in early modern human sites in Europe, Trinkaus said, "we start getting sites that represent larger populations." Simply living in a larger group has biological as well as social repercussions. Larger groups inevitably demand more social interactions, which goads the brain into greater activity during childhood and adolescence, creates pressure to increase the sophistication of language, and indirectly increases the average life span of group members. Longevity, in turn, increases intergenerational transmission of knowledge and creates what Chris Stringer calls a "culture of innovation"—the passage of practical survival skills and toolmaking technology from one generation to the next, and later between one group and another.

Whatever the suite of cultural buffers, they may well have provided an extra, albeit thin, layer of insulation against the harsh climatic stresses that Stringer argues peaked right around the time the Neanderthals vanished. Ice core data suggest that from about 30,000 years ago until the last glacial maximum about 18,000 years ago, the Earth's climate fluctuated wildly, sometimes within the space of decades. A few more people in the social unit, with a few more skills, might have given modern humans an edge when conditions turned harsh. "Not a vast edge," Stringer said. "Neanderthals were obviously well adapted to a colder climate. But with the superimposition of these extreme changes in climate on the competition with modern humans, I think that made the difference."

EATING THEIR OWN Cut marks on a Neanderthal jawbone, made when flesh was stripped off with a stone tool, testify to an act of cannibalism. All nine skeletons from El Sidrón show such signs of defleshing. Evidence of cannibalism—to satisfy hunger, or perhaps as a ritual practice—is not uncommon in Neanderthal fossils.



Which leaves the final, delicate—and, as Jean-Jacques Hublin likes to say, politically incorrect—question that has bedeviled Neanderthal studies since the Out of Africa theory became generally accepted: Was the replacement by modern humans attenuated and peaceful, the Pleistocene version of kissing cousins, or was it relatively swift and hostile?

"Most Neanderthals and modern humans probably lived most of their lives without seeing each other," he said, carefully choosing his words. "The way I imagine it is that occasionally

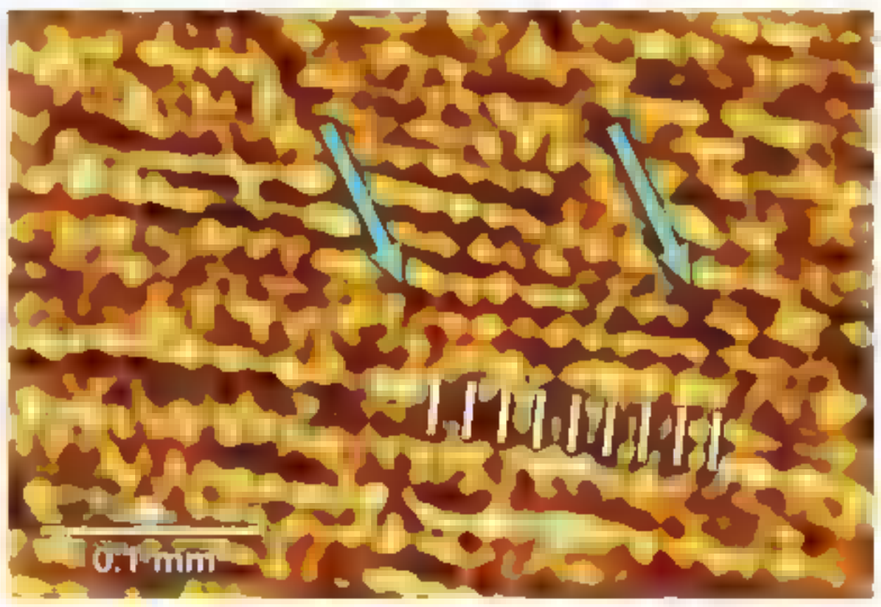
in these border areas, some of these guys would see each other at a distance…but I think the most likely thing is that they excluded each other from the landscape. Not just avoided, but excluded. We know from recent research on hunter-gatherers that they are much less peaceful than generally believed."

"SOMETIMES I JUST TURN OUT the lights in here and think what it must have been like for them."

Evolutionary biologist Clive Finlayson, of the Gibraltar Museum, was standing in the vestibule of Gorham's Cave, a magnificent tabernacle of limestone opening to the sea on the Rock of Gibraltar. Inside, fantastic excretions of flowstone drooled from the ceiling of the massive nave. The stratigraphy in the cave is pocked with evidence of Neanderthal occupation going back 125,000 years, including stone spearpoints and scrapers, charred pine nuts, and the remains of ancient hearths. Two years ago, Finlayson and his colleagues used radiocarbon dating to determine that the embers in

PHOTOGRAPHED AT GROUP OF PALEOANTHROPOLOGY, NATIONAL MUSEUM OF NATURAL SCIENCES, MADRID

DENTAL EXAM The perfect teeth in a 42,000-year-old jawbone from Le Moustier in France offer an opportunity to probe into the nature of Neanderthal adolescence. Scientists penetrated the upper right canine with x-ray beams generated in a synchrotron particle accelerator in Grenoble, France, revealing daily growth lines (bars) between thicker eight-day bands (arrows) in the tooth's enamel. The evidence pinpoints when the subject died, sometime right before or after his 12th birthday. For a young person, the molars were quite well developed, suggesting shorter childhoods for Neanderthals—and less time for brains to develop in the context of the social group.



WITH PERMISSION OF MUSEUM FOR PRE- AND EARLY HISTORY, STATE MUSEUM OF BERLIN (SMB) AND MPI (LEFT). PAUL TAFFOREAU, EUROPEAN SYNCHROTRON RADIATION FACILITY; TANYA M. SMITH, MPI, AND SMB (ABOVE)

some of those fireplaces died out only 28,000 years ago—the last known trace of Neanderthals on Earth. (Other hearths in the cave may be as young as 24,000 years old, but their dating is controversial.)

From pollen and animal remains, Finlayson has reconstructed what the environment was like from 50,000 to 30,000 years ago. Back then, a narrow coastal shelf surrounded Gibraltar, the Mediterranean two or three miles distant. The landscape was scrub savanna scented with rosemary and thyme, its rolling sand dunes interrupted by the occasional cork oak and stone pine, with wild asparagus growing in the coastal flats. Prehistoric vultures, some with nine-foot wingspans, nested high up in the cliff face, scanning the dunes for meals. Finlayson imagines the Neanderthals watching the birds circle and descend, then racing them for food. Their diet was certainly more varied than the typical Neanderthal dependence on terrestrial game. His research team has found rabbit bones, tortoise shells, and mussels in the cave, along with dolphin bones and a seal skeleton with cut marks. "Except for rice, you've almost got ■ Mousterian paella!" Finlayson joked.

But then things changed. When the coldest fingers of the Ice Age finally reached southern Iberia in a series of abrupt fluctuations between 30,000 and 23,000 years ago, the landscape was transformed into a semiarid steppe. On this more open playing field, perhaps the tall, gracile modern humans moving into the region with projectile spears gained the advantage over the

stumpy, muscle-bound Neanderthals. But Finlayson argues that it was not so much the arrival of modern humans as the dramatic shifts in climate that pushed the Iberian Neanderthals to the brink. "A three-year period of intense cold, or a landslide, when you're down to ten people, could be enough," he said. "Once you reach a certain level, you're the living dead."

The larger point may be that the demise of the Neanderthals is not a sprawling yet coherent paleoanthropological novel; rather, it is a collection of related, but unique, short stories of extinction. "Why did the Neanderthals disappear in Mongolia?" Stringer asked. "Why did they disappear in Israel? Why did they disappear in Italy, in Gibraltar, in Britain? Well, the answer could be different in different places, because it probably happened at different times. So we're talking about ▪ large range, and a disappearance and retreat at different times, with pockets of Neanderthals no doubt surviving in different places at different times. Gibraltar is certainly one of their last outposts. It could be the last, but we don't know for sure."

Whatever happened, the denouement of all these stories had a signatory in Gorham's Cave. In a deep recess of the cavern, not far from that last Neanderthal hearth, Finlayson's team recently discovered several red handprints on the wall, ▪ sign that modern humans had arrived in Gibraltar. Preliminary analysis of the pigments dates the handprints between 20,300 and 19,500 years ago. "It's like they were saying, Hey, it's a new world now," said Finlayson. □

Painting the Sky

BRILLIANT BLUR AS IT PLUCKS BUTTERFLY FROM THE AIR, THE EUROPEAN BEE-EATER LEADS COLORFUL LIFE ON THREE CONTINENTS

BY BRUCE BARCOTT

PHOTOGRAPHS BY JÓZSEF L. SZENTPÉTERI

Some birds were made for poems. Keats had his nightingale, Poe his raven. The European bee-eater's life is more like an epic novel, sprawling across continents, teeming with familial intrigue, theft, danger, chicanery, and flamboyant beauty.

The bee-eater darts across the sky in a gaudy patchwork suit: a chestnut crown, black robber's mask, turquoise breast, and throat feathers the hue of ripening wheat. Just the outfit for a bird that refuses to play it safe.

True to their name, bee-eaters eat bees (though they'll prey on dragonflies, moths, termites, butterflies—just about anything that flies). When the bird chases a bee, it flies like a heat-seeking missile, matching its prey's every twist and swoop. After a midair snatch, the bee-eater returns to its perch to de-venom the bee. It's a brutally efficient operation. Grasping the bee in its beak, the bird bashes the insect's head on one side of the branch, then rubs its abdomen on the other. The rubbing causes the stunned, sometimes headless bee to flush its toxins.

It's a good life, growing up as a European bee-eater *(Merops apiaster)*. The vast majority form clans that raise young in the spring and summer in a wide swath from Spain to Kazakhstan (a smaller group lives mainly in South Africa). Farmland, fields, and river valleys provide a bounty of insect hatches. Flocks of bee-eaters follow tractors as they churn up croplands. When they come upon a hive, the birds gorge themselves—a researcher once found a hundred bees in the stomach of a bee-eater near a hive. Some beekeepers are apt to shoot the birds, viewing them as profit-killing pests.

European honeybees overwinter by hunkering down in the hive, which dries up the bee-eater's main source of food. So, in late summer, the young bee-eater's idyll ends as its clan begins a long, dangerous journey. Massive flocks of bee-eaters from Spain, France, and northern Italy cross the Strait of Gibraltar, on their way over the Sahara to their wintering grounds in West Africa. Bee-eaters from Hungary and other parts of central and eastern Europe cross the Mediterranean Sea and Arabian Desert to winter in southern Africa. "It's an extremely risky stratagem, this migration," says C. Hilary Fry, a British ornithologist who has studied European bee-eaters for more than 45 years. As they converge on the Mediterranean, the birds often find themselves eluding Eleonora's falcons, which prey on migrating songbirds to feed their hatchlings. "At least 30 percent of the birds will be knocked out by predators or other factors before they make it back to Europe the following spring," Fry says.

Once the birds arrive in Africa, the social season kicks into high gear. Male bee-eaters stick with their own clan, while females leave to add their genes to a distant pool. Grass fires sometimes function as mixers, drawing bee-eaters from miles around to feast on the fleeing insects. Spanish-born males meet Italian-born females, Hungarian birds meet Kazakhs, and mates pair up for life. Come April, it's back to Europe. Yearling males return to their natal grounds with new mates. Home is usually a sandstone cliff or sandy riverbank shot through with used burrows, oval tunnels as long as a man's leg and wide as a fist. Not keen to start a family in a soiled nest, bee-eaters will pass up existing burrows and excavate their own. They peck and scrape for up to 20 days straight. By the end of the job they've moved 15 to 26 pounds of soil—more than 80 times their weight—and

Range and migration routes of the European bee-eater

NGM MAPS

After snatching a bumblebee in midair, a bee-eater uses a time-tested technique to avoid a sting: It whacks the insect against a branch until it's immobile, then rubs the stinger on the bark to expel the venom.

chipped a sixteenth of an inch off their beaks.

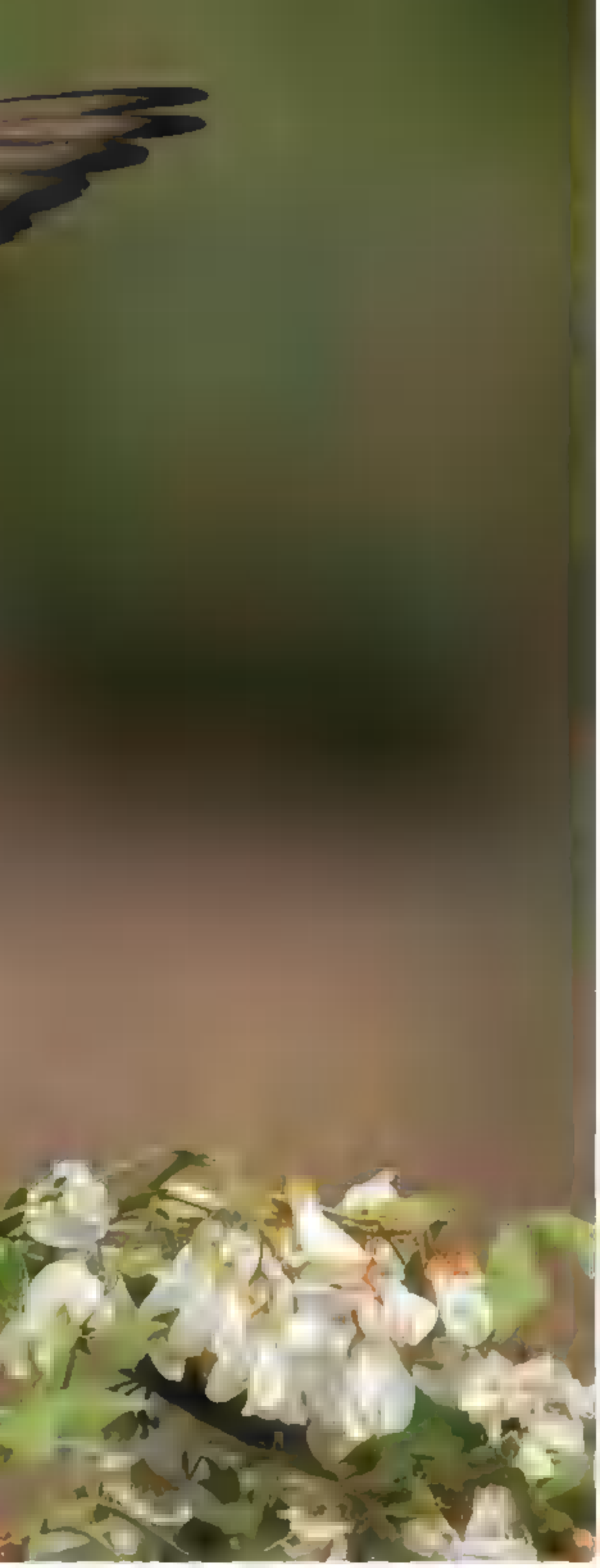
Nesting season is time for family alliances and intrigue. Members of the Meropidae family, which includes 25 species of bee-eaters, are famously cooperative breeders. In any colony there are apt to be numerous nest helpers—sons or uncles who help feed their father's or brother's chicks. The helpers benefit too: Parents with helpers can provide more food for chicks to continue the family line. The trick, of course, is to recruit helpers. Cornell University biologist Stephen Emlen, who spent nearly a decade studying the behavior of white-fronted bee-eaters, a cousin of the European species that lives in Kenya, found that they often use strong-arm tactics. After digging the burrow, a male bee-eater typically engages in courtship feeding—impressing his mate by bringing her a tasty bee or dragonfly. Emlen and his colleague Peter Wrege watched parents butt into their son's business, begging for the courtship treat or barging in between the mated pair. If that didn't work, a parent might block the entrance to the son's burrow, preventing the female from entering to lay her eggs. After a while some sons succumbed to the pressure, abandoning their own breeding efforts to become helpers at their parents' nests.

European bee-eaters aren't quite as ruthless. They're more likely to find helpers among males whose own nests fail through natural causes. Trickery and theft aren't uncommon, though. "Almost everything naughty you can think of happens in those colonies," says Fry. If a female leaves her burrow to feed, another female may sneak in to lay eggs—a tactic to fool the neighbor into raising a stranger's brood. Similarly, if a male leaves the nest unguarded, other males may seize the opportunity to copulate with his mate. Other bee-eaters occasionally turn to robbery, harassing neighbors who return with food until they drop the insect and the thief can fly away with the goods.

It's a short, spectacular life. A long-lived European bee-eater will survive five years, maybe six. The rigors of migration, dodging falcons along the way, take a toll on every bird. Bee-eaters today also have to contend with the loss of insects to pesticides and the disappearance of breeding sites as rivers are turned into concrete-walled canals. But what a story: bee chases, hive raids, brush fires, nest intrigue, and Gibraltar crossings packed into those years. "Common throughout its range," say the bird guides, but the phrase does this bold, beautiful bird injustice.

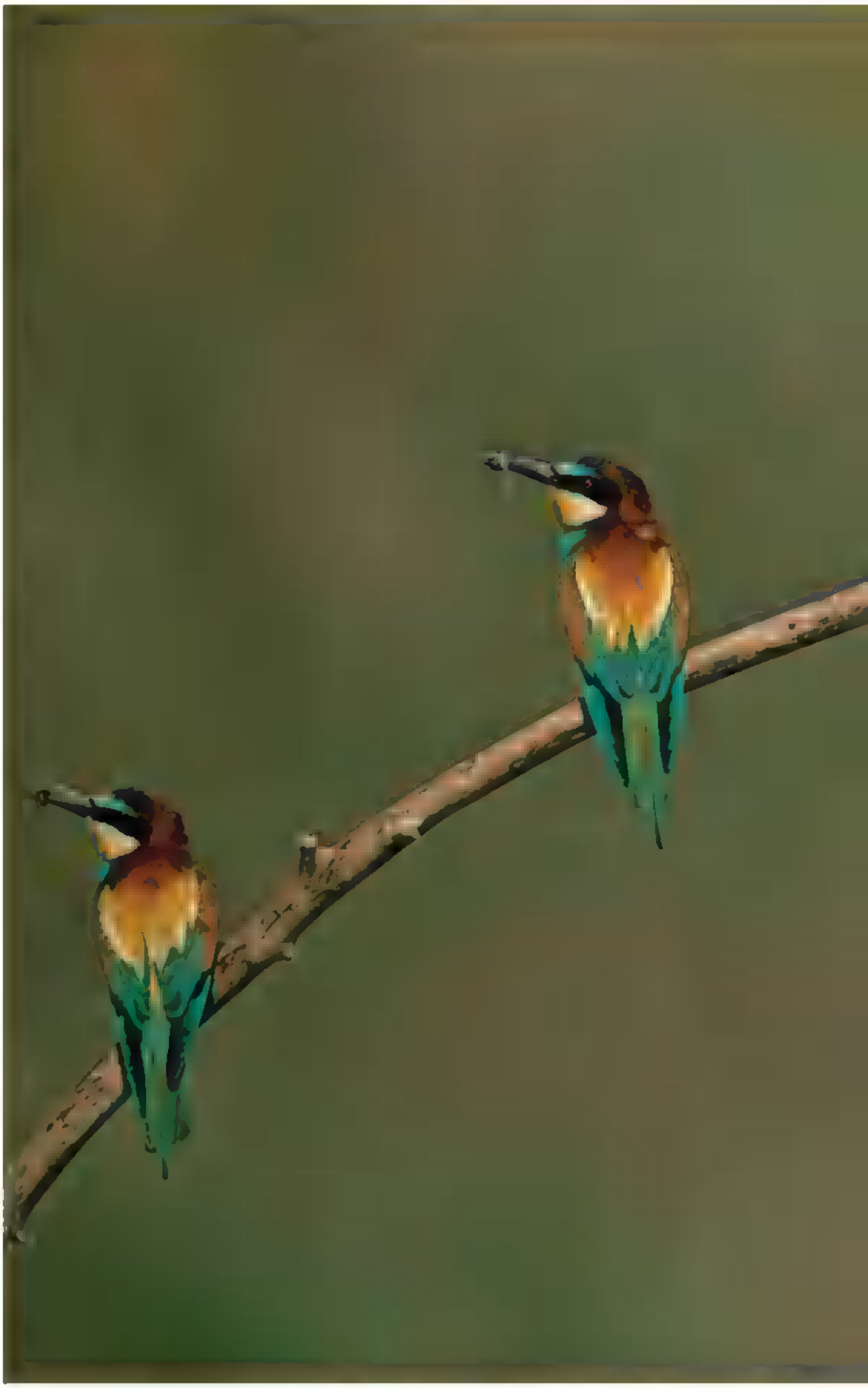
Bruce Barcott's most recent book is The Last Flight of the Scarlet Macaw. *József L. Szentpéteri photographed dragonflies for the April 2006 issue.*

THE BIRDS AND THE BEES For a male bee-eater, mating depends on finding food—such as a dragonfly (above). But before ■ bee-eater shares his catch with his mate, he woos her by conspicuously preparing his offering—tossing around ■ may bug (top right) before knocking it out. After eating her fill, the female emits ■ gobbling sound to beckon her suitor, who approaches with wings fluttering to maintain his balance (bottom right).

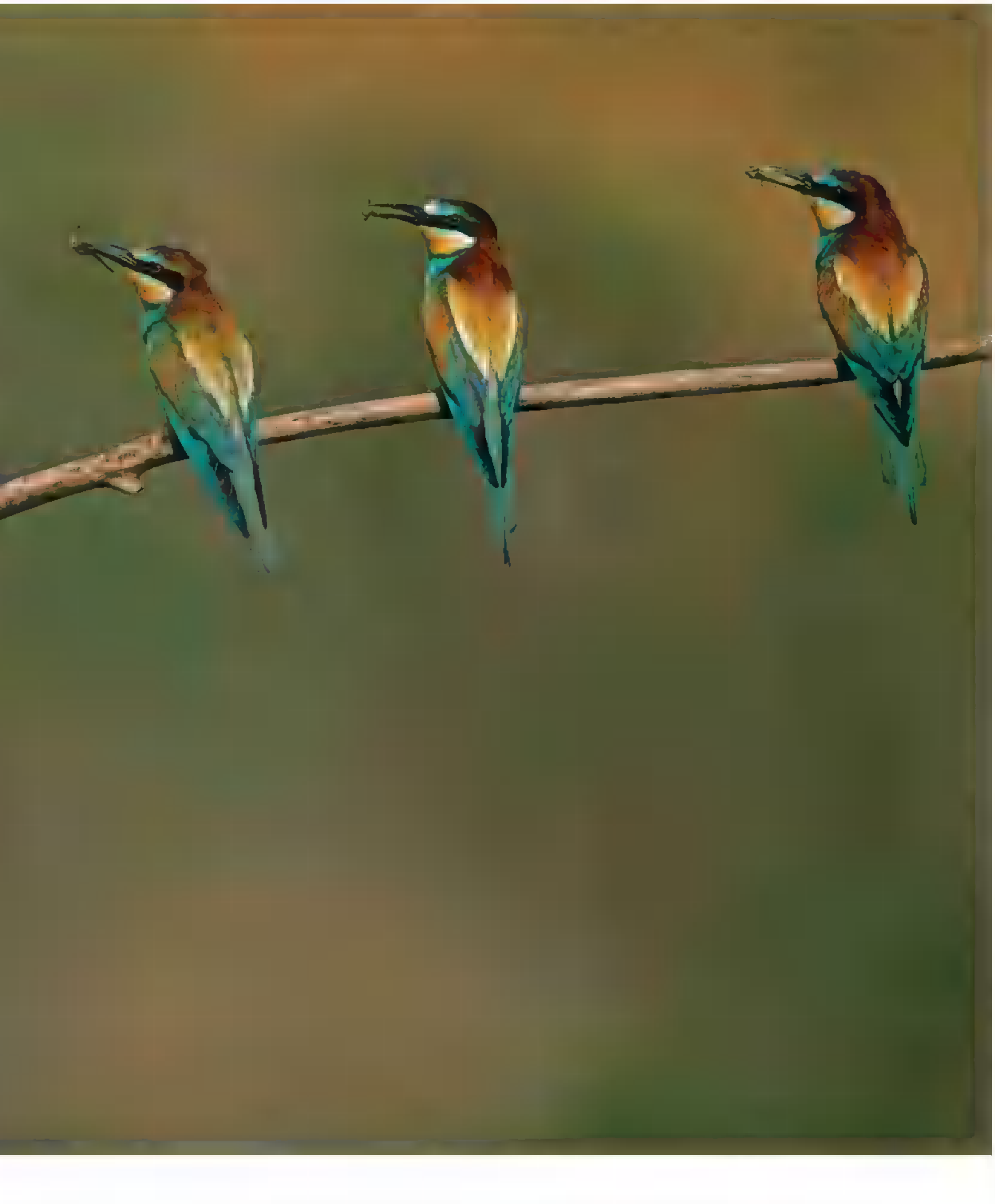


Brandishing stiletto-like beaks, male bee-eaters clash during mating season, when a colony's pecking order defines which birds will breed—and which ones won't.

HOLING UP In Hungary, adults fly to and from the nest tunnel they pecked and scratched into a sandy bank (above, and bottom right), foraging constantly to feed their ravenous chicks. Such tunnels can be three to five feet long. An adult in Romania delivers food inside the nesting chamber (top right). As countries in Europe increasingly sheathe their riverbanks in concrete, bee-eaters are forced to dig their tunnels in sand mines and dumps.



FLOCKING TOGETHER Beaks replete with prey, a band of bee-eaters eye their nests nearby. During the migration ahead, to and from Africa, roughly a third of the birds in each colony will die. Some bee-eaters don't need to make the risky journey: A small population of *Merops apiaster* never leaves Africa. Why does a single species travel such different paths? That's still up in the air. □



Unfurled to the horizon, the Golden Quadrilateral (GQ) soars above the Ganges on its way from Delhi to Kolkata

A NEW SUPERHIGHWAY LINKING ITS FOUR MAJOR

FAST LANE TO THE FUTURE

CITIES IS BRINGING OLD AND NEW INDIA INTO JARRING PROXIMITY.

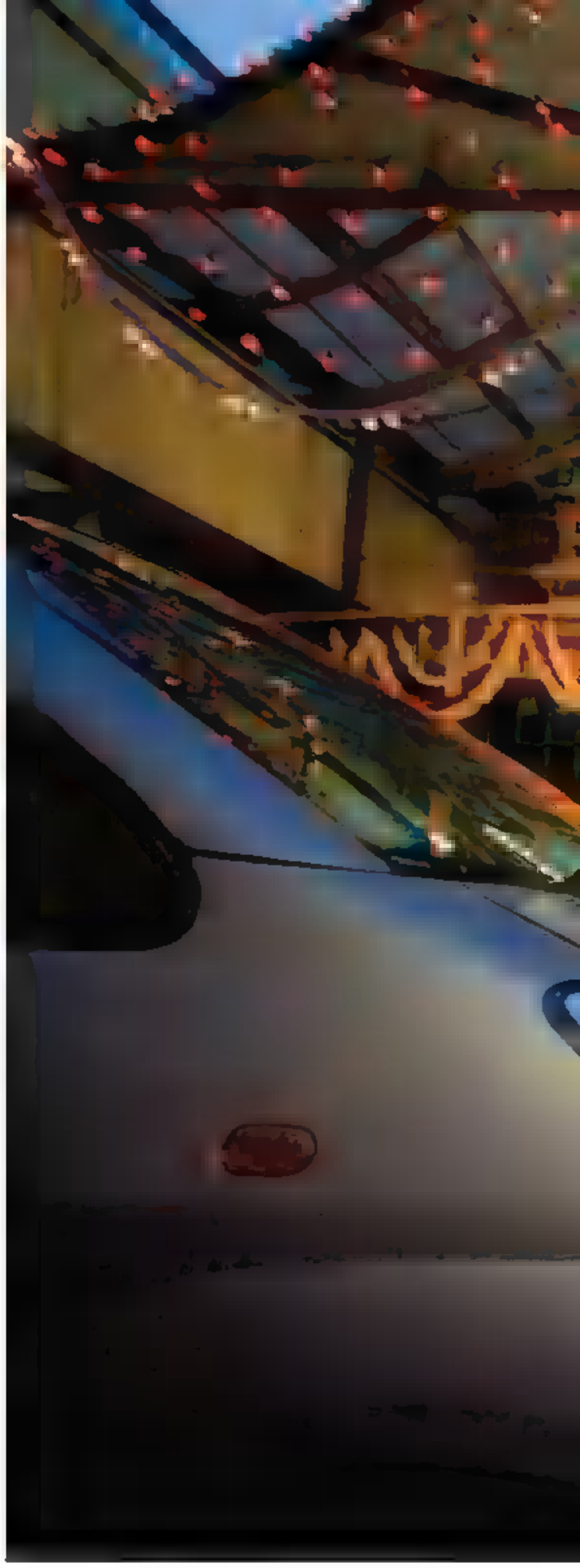

RJ27• 15M •0107

Sacred to Hindus, cows have the right of way—even on the GQ, where accident rates are much lower than on chaotic two-lane highways. "Driving in India is not about skill," says Tulsi Ram [illegible], "It's about reflexes"


N·P
ਗੁਰੂ

Muscled a factory worker from Bihar state clowns for his community of squatters near the highway in Delhi. Escaping the crushing poverty of rural life, millions of workers move to cities every year—a trend the GQ has accelerated.

BY DON BELT NATIONAL GEOGRAPHIC STAFF
PHOTOGRAPHS BY ED KASHI



India's new national highway, part crushed rock and asphalt, part yellow brick road, swings through Bangalore as it races across southern India bearing the turbocharged hopes of a billion people from the Arabian Sea to the Bay of Bengal. In downtown Bangalore the wheels roll to a stop, briefly, beside an ornate, 50-foot-high Hindu temple where every night a cheerful little man in horn-rimmed glasses named R. L. Deekshith, the temple priest, delivers the Hindu equivalent of curbside service. His specialty is the ritual called a puja, in which he spreads the munificence of the god Lord Ganesh upon a parade of newly purchased vehicles—cars, trucks, SUVs, motorcycles, and auto rickshaws, along with the occasional bicycle or bullock cart—whose owners wouldn't think of hitting the road without the blessings of a happy, four-armed god with the head of an elephant who brings prosperity and good fortune, particularly to machines and those setting out on something new.

Menaka Shekaran, a 23-year-old accountant for a company that imports exercise equipment, is waiting to have Mr. Deekshith conduct a puja over her silver motor scooter, which she just purchased this afternoon. Bright-eyed and slender, Menaka is dressed in the fashion one sees on thousands of young Indian women on motorcycles—designer jeans, brightly colored tunic, black heels, and a white scarf over her hair, wrapped to cover her nose and mouth.

As the priest works his way down a long line of vehicles, Menaka's older brother Dhana lights a coconut, circling the motor scooter three times with the smoking husk before smashing it to bits on the pavement in front of the scooter. He places a lemon under the front tire, which Menaka will try to crush when she rolls forward, a most auspicious beginning.

"Do you have a driver's license?" I ask her.

"No, sir, no," she giggles. At that moment Mr. Deekshith appears and drapes a garland of yellow flowers over the scooter's handlebars. He sprinkles holy water from the shrine of Lord Ganesh over the bike while reciting a mantra from the Hindu Vedas, and finishes by flicking droplets of red kumkum, an extract of turmeric,

Bearing flowers and a sacred flame, Hindu priest R. L. Deekshith conducts a puja, or ritual blessing, of vehicles in Bangalore, fortifying drivers with courage to venture into rush hour.

over the front of the scooter and dabbing a bit onto Menaka's forehead.

In thanks, Menaka hands him a gift bag of bananas and turmeric powder. Then she starts the ignition and guns the engine. She seems briefly baffled by the controls (Which one, again, is the throttle? Which one is the brake?) and struggles to keep the bike upright once she's pushed it forward off the kickstand, crushing the lemon to raucous cheers from Dhana and other onlookers. An auspicious beginning, but it looks as if she might keel over sideways into the traffic rushing by a few feet away. Alarmed, I grab hold of a handlebar.

"Do you have a helmet?" I shout over the sputtering engine. She shakes her head, grinning.

"Do you know how to drive?"

"No, sir, not really," she shouts back merrily, "but I'm planning to learn!"

With that, she jerks forward, peeling rubber as Dhana races alongside and nearly gets clipped by a passing car. She accelerates and plunges into the madness of evening rush hour in Bangalore with only Lord Ganesh to help

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Ed Kashi is an award-winning photojournalist whose documentary work in more than 60 countries has focused on social and political issues.

her. As she passes under distant streetlights, I can just make out the top of her head bobbing along in the seething current of 21st-century India, one more swirling pinpoint in a moving river of light.

The road under Menaka's wheels is one stretch of the Golden Quadrilateral (GQ), the brand-new, 3,633-mile expressway linking the country's major population centers of Delhi, Mumbai, Chennai, and Kolkata. It is part of the largest and most ambitious public infrastructure project in the country's history, one with a social engineering goal at its heart: Much as the U.S. interstate highway system mobilized American society and grooved the postwar economy, India hopes the Golden Quadrilateral will push the country's economic engine into overdrive—bringing the benefits of growth in its booming metropolises out to its impoverished villages, where more than half the population lives.

Announced in 1998 by then Prime Minister Atal B. Vajpayee, who is credited with giving the project its grandiose name, the Golden Quadrilateral is exceeded in scale only by the national railway system built by the British in the 1850s. For decades after its 1947 independence, India practiced a kind of South Asian socialism in keeping with the idealism of its founders, Gandhi and Nehru, and its economy eventually stalled. In the 1990s the country began opening its markets to foreign investment, led by a pro-growth government and staffed by an army of young go-getters who speak excellent English and work for a fraction of the wages paid in the West. Yet India's leaders realized their decrepit highways could hobble the country in its race toward modernization. "Our roads don't have ■ few potholes," Prime Minister Vajpayee complained to aides in the mid-1990s. "Our potholes have a few roads."

Ten years after Vajpayee's announcement, the GQ is among the most elaborately conceived highway systems in the world, a masterpiece of high-tech ingenuity that is, in many ways, a

Steady hands and a solid education took Tamil Selvan, 29, from a remote village to the suburbs of Chennai, where he now works for Hyundai. Via the GQ, the company ships cars all over India—and the world.

calling card for India in the 21st century. Seen on a 48-inch flat-screen computer monitor at highway administration headquarters in Delhi, the GQ seems as beautiful as a space capsule. Its designers describe it as an "elegant collection of data points," or a gleaming, "state-of-the-art machine," a technologically advanced conveyor belt moving goods and people around India with seamless precision.

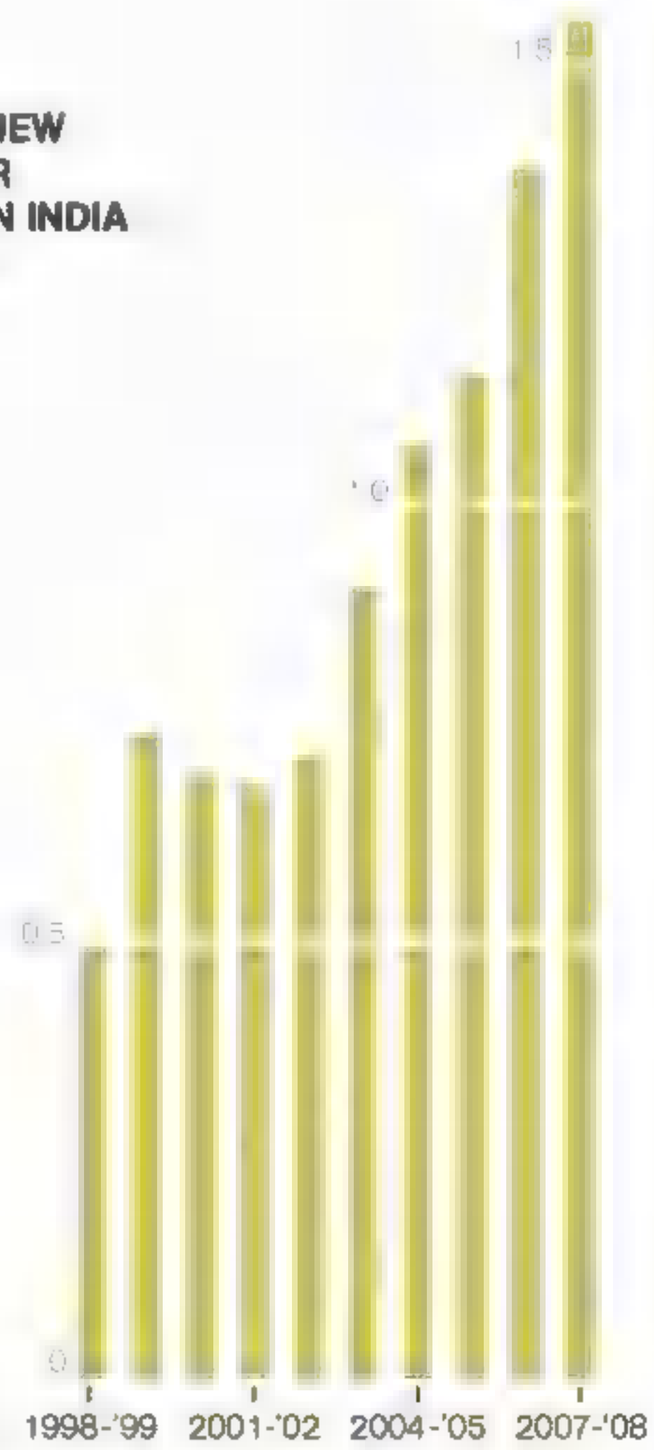
It's easy to be swept up in their enthusiasm for a system so technologically advanced that one day, any rupture in the pavement could be detected by sensors and maintenance crews dispatched; where tolls would be computerized and instantly tabulated against long-term projections; where accidents trigger an instantaneous response from nearby emergency teams. And there is no doubt that the highway and the development it has generated have quickened the pulse of the nation, boosted traffic volume, and brought millions of workers pouring into medium-size and large cities from the countryside. Yet the GQ has also brought old and new India into jarring proximity, challenging the moral and cultural underpinnings of a nation founded on Gandhian principles of austerity, brotherhood, and spirituality. It's sharpened India's appetite for material possessions—especially cars—and many Indians, especially those over 30, have a hard time recognizing the India they see advertised on television and billboards, which comes in a wide choice of designer colors and does zero to sixty in under ten seconds.

"I see the GQ as a metaphor for modern India, speeding along today at a hundred miles an hour," says historian Ramachandra Guha, author of *India After Gandhi*. "Imagine we stop at a traffic light and roll down the window. There's a path next to the highway, and a little old guy riding past on a bicycle. As we wait impatiently for the light to change, he calls to us to watch out, slow down, don't be so reckless and single-minded in our pursuit of growth and affluence and material goods. Well, that chap on the bicycle is Gandhi. He's our conscience,

INDIA HITS THE ROAD

As highways beckon and incomes rise, Indians are itching to get behind the wheel. They bought more than 1.5 million new passenger vehicles over the past year, and sales are projected to double by 2015, raising India's appetite for global oil and hiking its carbon emissions. "India's mentality is changing from 'save, save, save' to 'spend, spend, spend,'" says Subhabrata Ghosh of Saatchi & Saatchi/India, responsible for many of the billboard campaigns targeting buyers in India's cities.

SALES OF NEW PASSENGER VEHICLES IN INDIA
(in millions)



SOURCE: SOCIETY OF INDIAN AUTOMOBILE MANUFACTURERS

Someday the GQ will rise above the traffic jams of Bangalore, but for now it's "good living" for men like Sujit Roy, who supports his family in distant Murshidabad with the eight dollars a day he earns as a foreman on the construction site.

and even with all that's changed in India, he cannot be ignored."

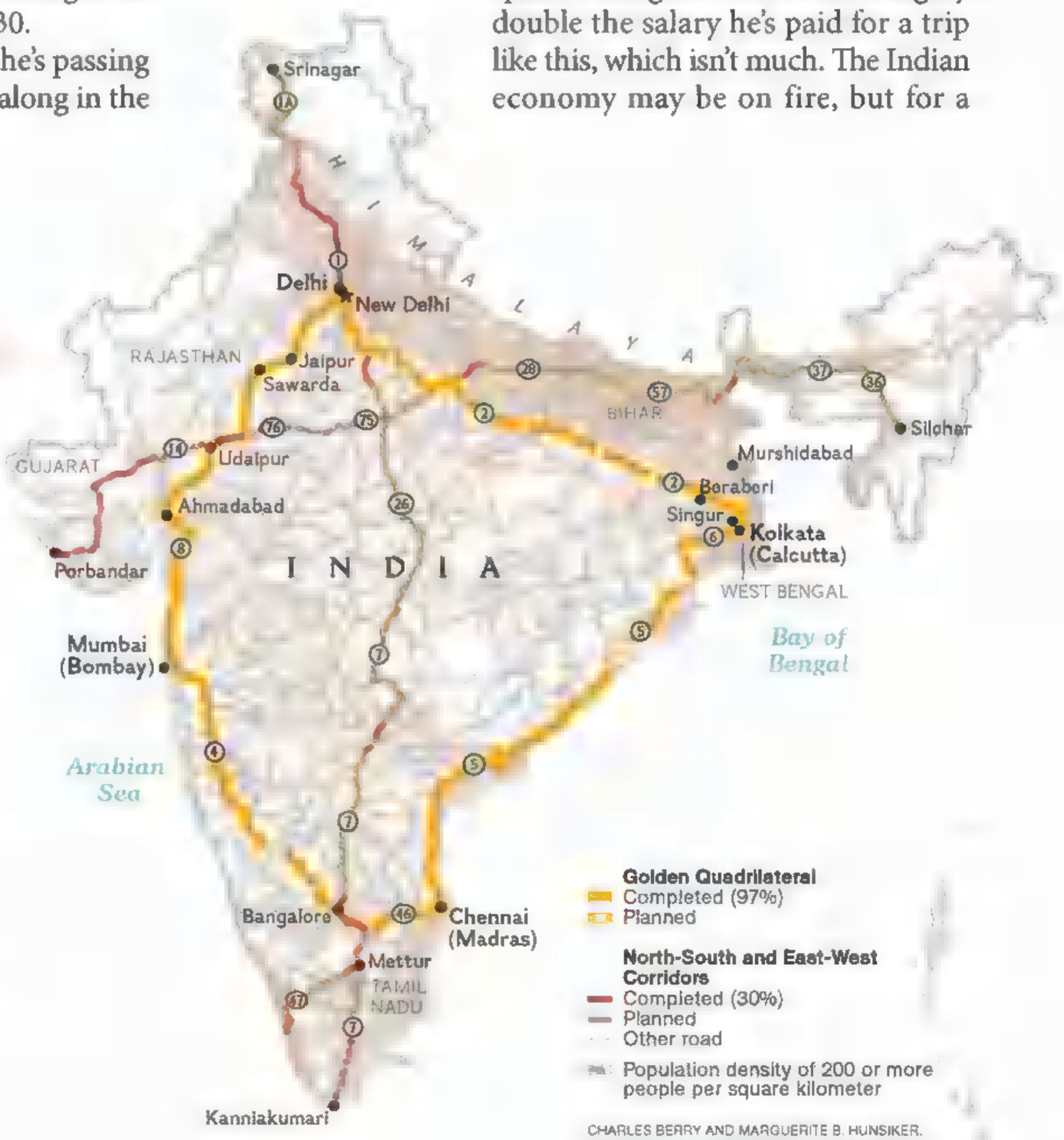
Seen through the windshield of Rakesh Kumar's truck, the Golden Quadrilateral is a shadow play on asphalt lit by bouncing beams of light, a tedious slab of man-made rock animated by high-beam creatures that jump out from shadows along the road and vanish the instant you see them: the side of a cow, a mound of hay, the corpse of a dog, a ghost on a bicycle. It's 3:30 in the morning, and Rakesh and his 19-year-old nephew Sanjay are chewing high-octane masala tobacco—which keeps them awake by burning their gums—scratching bedbug bites, and listening to screechy Bollywood love songs that Rakesh plays over tinny speakers loud enough to wake the dead. "TRUCK DRIVING MUSIC!" he yells over the sound of the engine, which is roaring like a 747 though the truck is barely doing 30.

Even at that speed, he's passing other trucks laboring along in the slow lane, and Sanjay's job is to signal Rakesh with loud slaps on the door frame when they've cleared the passed truck. They're 250 miles north of Mumbai in the state of Gujarat, hauling nine tons of candle wax, fabric dyes, and electrical supplies to the factories of Delhi. They've already blown two tires tonight—Rakesh stopped at a roadside tire stand and rousted the mechanic out of bed to patch them—and now he's racing to reach a checkpoint by 4 a.m., when he's scheduled to meet a friend of his boss's. This man will "guide" them through the checkpoint at the Rajasthan state line, he says, since the truck is overloaded.

In spite of the 50-mile-an-hour speed limit on the GQ, Rakesh usually drives 40 miles an hour or slower to save fuel; the owner gives him a reasonable allowance for expenses, and Rakesh is free to pocket any money he doesn't spend. If all goes well, he can roughly double the salary he's paid for a trip like this, which isn't much. The Indian economy may be on fire, but for a

INDIA'S INTERSTATES

Launched in 1998, the Golden Quadrilateral is part of a $30-billion-plus National Highways Development Project—the most ambitious building spree here since Britain created the railway system in the 1800s. Up next: completing the North-South and East-West Corridors, and a network of local highways designed to reach every town of more than a thousand people, bridging India's urban-rural divide.



man like Rakesh, with a wife and four kids to support, every rupee counts. When I visited his home on a dusty side street in Ahmadabad, all four kids—two boys and two girls ranging in age from three to 18—proudly demonstrated their contribution to the family finances, retooling brushes on the living room floor for a local textile manufacturer. "In this family, if you don't work, you don't eat," said Rakesh.

A tough, funny, straight-talking man of 42, Rakesh is built like a former boxer—right down to the punched-in nose—but you'd be wrong if you mistook his machismo for recklessness. This is a guy who's been driving trucks professionally for 22 years. He values his reputation as a safe and sober driver. "Of the drivers on the highway tonight, I'd bet that 90 percent are high on something," he says—hashish, liquor, or *doda*, a tealike mixture of opium and betel nut that many drivers use to stay alert, but which also clouds their judgment. Still, he prefers driving at night, when it's cool and the GQ is freer of the human and animal traffic that can slow a driver down or cause an accident.

It's not unusual, on a six-lane superhighway, to find oxcarts, water buffalo, motorcycles, and the occasional line of trucks and cars coming straight at you, in your lane, driving the wrong way because it's shorter or easier or perhaps because they're confused. Goats graze the median strip, and traffic is often held up by sacred cows, the only users of the highway that seem oblivious to the danger flying around like shrapnel.

Towns cut in half by the highway are especially dangerous, since crowds of pedestrians cross in the face of oncoming traffic, which almost never breaks speed voluntarily. In some of these towns, congestion is so bad that the GQ comes to a standstill, and the fundamental laws of Indian traffic, which resemble those governing swarms of bees, take hold. To cross a busy intersection is to catch a glimpse of the Indian character: enterprising, creative, pushy, energetic, relentless, and surprisingly good-natured. As you wait to cross, you're aware of a constant push around your edges, a jockeying for

Laborers haul sand and gravel dredged from the Tansa River, which contractors sell to roadbuilders north of Mumbai—an industry that supports hundreds of villagers, along with workers from other parts of India.

Road rage is just a game at Palm Meadows, a gated community in Bangalore
India's booming economy reflects the "entrepreneurial zeal of the nation,
says village boy turned technology guru J. K. Misra, who lives down the street

position that seeks to flow past you on the way to the other side. There's nothing hostile about it; it's just that standing still is not an option.

Shortly before reaching the toll plazas at Udaipur, Rakesh decides to leave the GQ and take an alternate route through the hill country to the west. Though slower, this two-lane highway saves him about $20 in tolls. It also provides a glimpse of what life was like before the GQ. The accident rate on two-lane highways in India is much higher than on the GQ, and that, says Rakesh, "is probably the best thing about these new highways. They're a lot safer."

In midafternoon we pass a ghoulish wreck—a truck pulling out onto the highway had been hit broadside by an 18-wheel flatbed speeding downhill with two eight-ton blocks of white marble from a local quarry. The enormous blocks hadn't been lashed down but were simply resting on the truck bed. Upon impact, both slid forward and flattened the cab, crushing the driver and his two helpers to death.

In such cases, mobs often quickly form and attack the surviving driver, regardless of whether he was at fault. I came upon half a dozen accidents during my travels on the GQ, and invariably the crowd was agitated, far more interested in meting out justice than in giving first aid to the poor soul broken and bleeding in the roadway. One night, Rakesh says, he collided with an auto rickshaw that recklessly pulled out in front of him. As he tried to help the rickshaw driver, he noted with alarm that a mob was forming, yelling for the truck driver's blood. He quickly slipped in among them and joined the chorus shouting, "Where is that sonofabitch driver? Kill him!"

If not for the GQ, 29-year-old Tamil Selvan might still be farming coconuts in his village in the southern Indian state of Tamil Nadu. Instead, young Tamil dutifully rode his father's bicycle to and from a government school in a larger village a few miles away. Next he attended a technical institute in a nearby town, and now he works as a senior technician at the giant Hyundai car factory on the GQ just west of Chennai, finding and fixing flaws in the silvery metal shells that come sweeping down the assembly line, pausing at each workstation for an average of 64 seconds. Once assembled, his handiwork is painted and polished and shipped, via trucks on the GQ, to the port at Chennai and then all over the world—an outcome that, even after ten years on the job, Tamil still finds hard to fathom. "Think of all the things these cars endure during their lifetimes"—he says earnestly—"all the extremes of weather, the different roads and traffic around the world. It's hard to believe their journey starts here."

MUCH AS THE U.S. INTERSTATE HIGHWAY SYSTEM MOBILIZED AMERICAN SOCIETY, INDIA HOPES THE GOLDEN QUADRILATERAL WILL PUSH THE COUNTRY'S ECONOMIC ENGINE INTO OVERDRIVE.

Tamil, a quiet, solidly built family man with a mustache, spends his nine-hour workday in a uniform—dark blue polo shirt and pants, white dust mask, orange earplugs, white gloves—and seems always to have a tool in his hand. He was one of Hyundai's original hires in 1998, after the South Korean automaker built its factory here on a flat, 535-acre tract of land. Today Hyundai's 5,400 employees embody the qualities that have helped make India one of the hottest destinations in the world for manufacturers. Martii Salomaa, a Finnish manager at the neighboring Nokia factory that opened in 2006 and now employs 9,000 people, says India has "the most amazing workforce in the world. People here are creative, driven, full of energy and new ideas. You don't need to push them, because they push each other relentlessly; the challenge is channeling their incredible energy."

Tamil doesn't think of himself as a fast-lane innovator so much as a problem solver, just like millions of other south Indian kids who grow up in a village miles from the nearest paved road and help their fathers, as Tamil did, farm small plots of mangoes and rice and coconuts. At work, one of Tamil's suggestions—to run a second hydraulic line under the workstation so the team's drills could be used efficiently on both sides of the car—was just common sense, but it saved the company thousands of hours

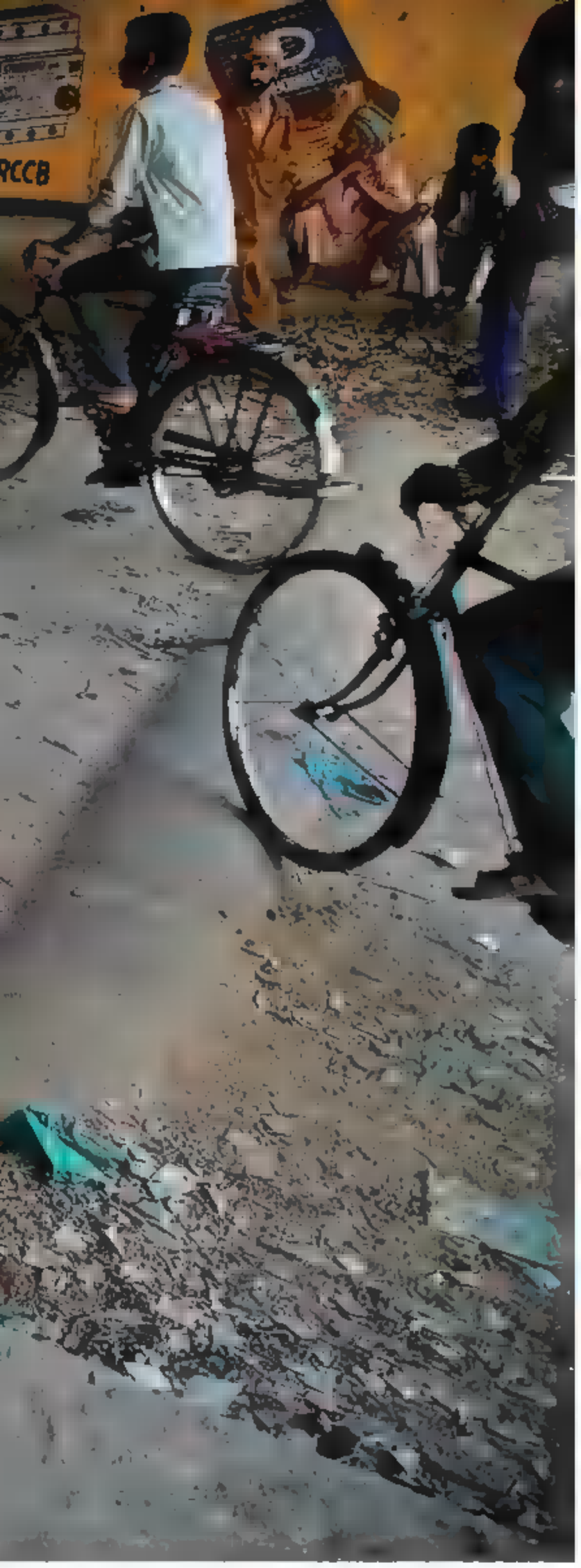
A handy footpath for women toting wheat in Rajasthan state (below), the highway can also knock the legs out from under farmers whose fields, and livelihoods, are destroyed when government takes land for the roadway or to create industrial parks. In West Bengal (above), farmers have repeatedly clashed with police since the state government appropriated their lands near the GQ for an auto factory.

Doing a lively business at curbside—an Indian tradition—a fishmonger on the outskirts of Chennai works the zone of confiscated land between the road and buildings on the shoulder, which have been partly razed to expand the GC

Death came early for a 15-year-old truck driver's helper killed in a head-on collision on the GQ. "He ran away from home four days ago," says his uncle, who came to claim the body. "This was his first job."

and earned him recognition as Hyundai's Man of the Month. It is his proudest accomplishment, and he keeps the award certificate, with the printed inscription, "V ARE PROUD OF YOU," in a special book at home. He used the 2,500-rupee cash award to help buy a second-hand motorcycle so that he, his wife, and young son could travel to his home village for festivals and occasional weekend visits.

Every factory on the GQ, including Hyundai, creates its own "ecosystem," opening dozens of specialized niches that are quickly filled by energetic Indian entrepreneurs. Hyundai, for example, is surrounded by 83 smaller companies, which supply it with windshields, fasteners, headlights, rearview mirrors, and other specialty parts. Each of these companies in turn has suppliers of its own to provide truck transport, warehousing, clerical services, and logistical support. India has also created Special Economic Zones (SEZs) that provide new infrastructure and a tax holiday to foreign companies making products for export using Indian workers. Today there are more than 200 SEZs in India, which generate more than $15 billion in annual exports and provide jobs for more than half a million Indian workers. The vitality of these ecosystems is partly responsible for India's soaring economic



growth rate of 9 percent a year, second only to China among comparable market economies.

Yet unlike China, India is a freewheeling democracy where clashes over land for the highway and its enterprise zones are inevitable. In a country as densely populated as India—more than a billion people living in an area about a third the size of the United States—seemingly every inch of viable land is spoken for. Building a factory gobbles farms; widening a highway displaces thousands of small shops, restaurants, truck stops, tea stalls, and other businesses. Roads do change everything, and not always to everyone's advantage.

Taunts and tear gas canisters were whistling through the air one hot Sunday afternoon last year, when the war over land erupted near Singur, a farming district west of Kolkata along the Golden Quadrilateral. The scene unfolded amid billowing clouds of tear gas, which drifted back and forth across a pastoral landscape like a scene from the Civil War. Massed on one side of a flat, open field in a Gandhian display of civil disobedience were several thousand farmers from surrounding villages, who had gathered to take back land seized by the government. Facing them was a battle line of several hundred state police in khaki uniforms, armed with shields and lathis, heavy, four-foot-long bamboo staffs capable of rendering a farmer senseless, or lifeless, if swung with enough force.

Behind the police line was a ten-foot-tall brick wall surrounded by barbed wire, and behind that 645 acres of farmland that the West Bengal state government had leased to Tata Motors, the giant Indian automaker, as incentive to build a factory here. Adjacent to the GQ and just an hour from Kolkata, the site had clear advantages for a $560-million company that ships its products all over India and the world, and Tata Motors, assured by state officials that they had followed due process of the law, had already committed to build its revolutionary $2,500 car here.

Over the past decade, India's Highway Authority has gone to extraordinary lengths to compensate those in the path of the Golden Quadrilateral. Usually landowners and tenants have been paid by the Indian government, partly with funds loaned by the World Bank for that purpose. In the adjacent enterprise zones, the burden rests with state governments to acquire acreage for economic development. Ironically, it's the Communist Party leaders of West Bengal—one of India's poorest states, lagging years behind in economic development—who've turned suddenly and rabidly pro-business, resorting to land confiscation and strong-arm tactics to lure manufacturers at the expense of the poor farmers who elected them in the first place. When that happens, the clashes over land turn ugly.

Here in Singur, an old woman, furious, staggered bravely across the battlefield toward the police line, swinging a heavy stick that was bigger than she was. "Our lands are being stolen from

us! Where is your humanity?" she screamed hoarsely, to cheers from the hundreds of protesters who followed her. Bare-chested teenage boys, stirred by her courage, dashed forward and threw rocks and bricks at the police, who batted them away with their shields. At a signal, the police front line began moving toward the demonstrators with their lathis raised, as others launched tear gas canisters and fired rubber bullets at the farmers. In the clash that followed, dozens of protesters were injured, although the police likely restrained themselves because journalists were present. That night, after we left, the police returned in force, arresting the leaders of the protest, beating many more with their lathis. The state intelligence bureau called our guide and issued a warning: If we came back, we'd be questioned too.

A few days later some of the protesters gathered at a nearby farming village called Beraberi. A farmer named Kashinath Manna, 75, his eyes shining like a teenager's, spoke about the seven acres he and his two brothers had farmed since they were children, land they inherited from their father, and from his father before him. Their crops are irrigated from tube wells that the Indian government drilled during the agricultural green revolution of the 1960s to combat malnutrition and make India self-sufficient. That well water, Kashinath says, was the magic ingredient; it unlocked the fertility in the soil to produce up to five harvests a year—of okra, beans, potatoes, hemp—a yield rich enough to support the extended family, 32 children and grandchildren, who depend on Kashinath and his brothers. "We produced so much that I had to use a bicycle rickshaw to haul it to market," he says.

These days Kashinath can carry his crops to market in a canvas bag slung over his shoulder. That's all he can grow on his share of a third of an acre of land, which is what the family has left now that Tata Motors is moving in next door. He will never forget the day they lost the rest. It was early morning, just after dawn, and as he turned off the dirt road of his village onto the footpath leading to the family's land, he was shocked to see that a cordon of police stood between him and the fields; behind them, workers were putting up a barbed-wire fence. As he approached, the police raised their weapons and told him to go home. It was as if he'd been stripped naked, he says. "We are only farmers," he says sadly. "That's all I know how to do. I've been thinking lately of suicide." One of Kashinath's best friends, also a farmer, killed himself a few months ago.

IN THE PAST TWO DECADES, THE NUMBER OF INDIANS LIVING BELOW THE POVERTY LEVEL HAS DROPPED DRAMATICALLY—AN ACHIEVEMENT THAT GANDHI WOULD HAVE CELEBRATED.

The government of West Bengal claims powers of acquisition under an 1894 law and maintains that most farmers in Singur willingly vacated their lands in return for compensation. That claim offends Kashinath. No farmer would voluntarily give up fertile land, he says. "And if we gave it willingly, why do they need to deploy the police against us? I'm not a criminal. I haven't done any harm to anyone in my life. But now I'm sick with worry. What will we eat? How will we live? What is the future of our children?"

Anuradha Talwar of the West Bengal Agricultural Workers Union says that "many farmers were intimidated by party workers into giving written consent for the occupation of their land," and that only about 60 percent of the land was lawfully transferred. To press the issue, her organization filed a lawsuit on behalf of the farmers, which is currently making its way through the courts.

Across the country in his Mumbai office, Ravi Kant, managing director of Tata Motors, a revered Indian company with a record of social responsibility, admits that at Singur "there's room for improvement," but prefers to focus on the 2,000 jobs and various other economic advantages his factory on the Golden Quadrilateral will bring to the people of West Bengal, one of the least developed states in the country. "In the end, many more people will benefit from this project than be hurt by it," adds his colleague Debasis Ray, himself a native of West Bengal. "That's the nature of progress."

Farmers are already feeling the benefits of the highway in some areas. In Mettur, a tidy farming village at the end of a one-lane road, the parents of Tamil Selvan, the Hyundai worker, now live in a fine, two-story house made of concrete blocks 170 miles from the factory where their son works. Next door is their original one-room house of sticks and mortar, which they now use to store coconuts, potatoes, and burlap sacks full of rice. A few years ago the state government paved the road to the village, connecting it to secondary highways and from there to the GQ and distant markets. Another innovation of the 1990s—wireless telephone networks, which followed the path of India's highways to give road travelers uninterrupted coverage—helps farmers take advantage of the new roads. In places like Mettur, for the cost of a $30 cell phone and a few dollars a month, farmers can now conduct trade from hundreds of miles away, eliminating the middleman and removing some of the guesswork from long-distance hauling and selling.

"The roads have changed everything," says Tamil's father, Devaraja Pillai, a warm, dignified man of 59. "It used to be that we could only sell our crops in the towns nearby, and prices were low. Now we've got a truck, which we use to haul our coconuts and mangoes to bigger markets like Bangalore and Chennai. We can get seven rupees a pound for our coconuts in Bangalore, three times what we make around here. And we can get there in about half the time it used to take, so our crops don't spoil." A part-time farmer, Tamil's father is also the village schoolteacher, ■ poet, and a devotee of the 19th-century guru Swami Vivekananda, whose long hair and large, beatific eyes appear in photographs around the house. On the bright green wall of the living room, he has posted one of Vivekananda's sayings: "Education is the manifestation of perfection already in man." Those words became his credo.

Six months after Tamil started at Hyundai, the company invited the families of their new workers to visit the plant, all expenses paid. Tamil's mother and father made the bus journey

No one was hurt when a truck carrying hay took a spill on a curve near Jaipur. Such mishaps are common on the GQ; though designed to be state-of-the-art, the highway is only as good as the drivers who use it.


Workers from drought-stricken Sawarda village say the GQ has brought
prosperity closer to home. "Today the
hours away," says one. "With the

to Chennai along the Golden Quadrilateral and were overwhelmed by the size of Hyundai, which Tamil had warned them was a "huge company, like a sea." They watched, wide-eyed, as their son operated equipment worth millions of dollars and marveled at the efficiency of the assembly line, described by his father as "one side robot, one side man, working as one being."

Devaraja also saw the perfection in Tamil as never before, a manifestation of the acquired skill and confidence that today frees millions of rural Indians from the bonds of caste and geography. In the past two decades, the number of Indians living below the poverty level has dropped, and the middle class has grown dramatically—an achievement that even Gandhi would have celebrated.

India's founding father, still revered, is a symbol of an India that is difficult to imagine ever being paved over by a highway or seized for new factories. But these days, Gandhi is many things to many people. "India may have evolved past the 'austerity' mind-set, but Gandhi has never been more relevant than he is today," says Subhabrata Ghosh, an executive at Saatchi & Saatchi/India who keeps a keen eye on the national zeitgeist. "Gandhi is about courage, competence, empowerment, and a willingness to manifest change. It's true we live in a time when there is no freedom struggle. But there is a global marketplace, and Gandhi was one of the most fiercely competitive people who ever lived. He threw out the British without firing a shot!"

In the fast lane to Delhi, I finally met up with the Gandhi that Ramachandra Guha suggested I watch for, the wise man on the bicycle telling Indians to slow down, be gentle, don't forget who you really are. One morning in Rajasthan, all vehicles were forced off one side of the highway by a herd of several hundred Brahman cattle being driven, against traffic, by a pair of colorfully dressed nomads. As the animals grazed on bushes in the yard of a house nearby, I noticed an old man reclining under a pipal tree, smoking a hookah. Behind him, a dusty bicycle leaned against the wall of his compound, a few hundred feet from the highway. I wandered over just as he was trying to call back his dog, which was barking ferociously at the cows: "Beevcoof! You idiot! Get back here!" His name was Deen Dayal, he said, and he looked like something out of the British-Afghan wars, with his huge, white handlebar mustache, buzz cut, and bright eyes full of mischief. In a strong, commanding voice, he said he's 80 years old and owns land on both sides of the highway, along with three *dhabas,* or truck stops, and a gas station that's making money hand over fist, thanks to traffic on the GQ. These days he rides his bicycle on footpaths between the house and his businesses, but he doesn't dare ride on the highway anymore. "I don't hear that well, and these cars are going so fast it scares me. Half my land is on the other side of the highway, and I'm too scared to cross the road."

While we were on the subject of the road,

Seekers of peace in Rajasthan visit ■ roadside shrine, beneath a tree so sacred that it humbled the mighty GQ. "When workers tried to cut it, their saws broke," marvels a trucker. "Now the highway goes around."

he said, "I'm very angry. I just found out that they're going to widen the highway again, and take my whole yard this time." He showed me a metal stake driven two feet beyond the corner of his front wall. "These highway guys came with 15 or 20 cops and measured to here," he said. "My yard, my tree, my resting place—all gone."

We sat in silence a while, and then, calmer, he told me how it was before there were roads, and they had to walk ten miles to the nearest train station. He lived through the partition of India and Pakistan, and he talked about that too.

"Did you ever happen to meet Gandhi?" I asked.

"I did," he said. Just after independence, there was a big push for new roads, and the government planned to put one here. "But they wanted to run it right through our farm, where the highway is today. So my father and I and a group of other people took the train to Delhi to ask Gandhiji and Nehru to move the road to the edge of our land so it wouldn't be cut in half."

"How did it go?" I asked.

"Oh, it was very nice," he said. "They met with us and shook our hands and listened to our arguments very politely. And then they went ahead and did exactly what they were planning to do all along." □

RIGHT WHALES

ON THE BRINK

ON THE REBOUND

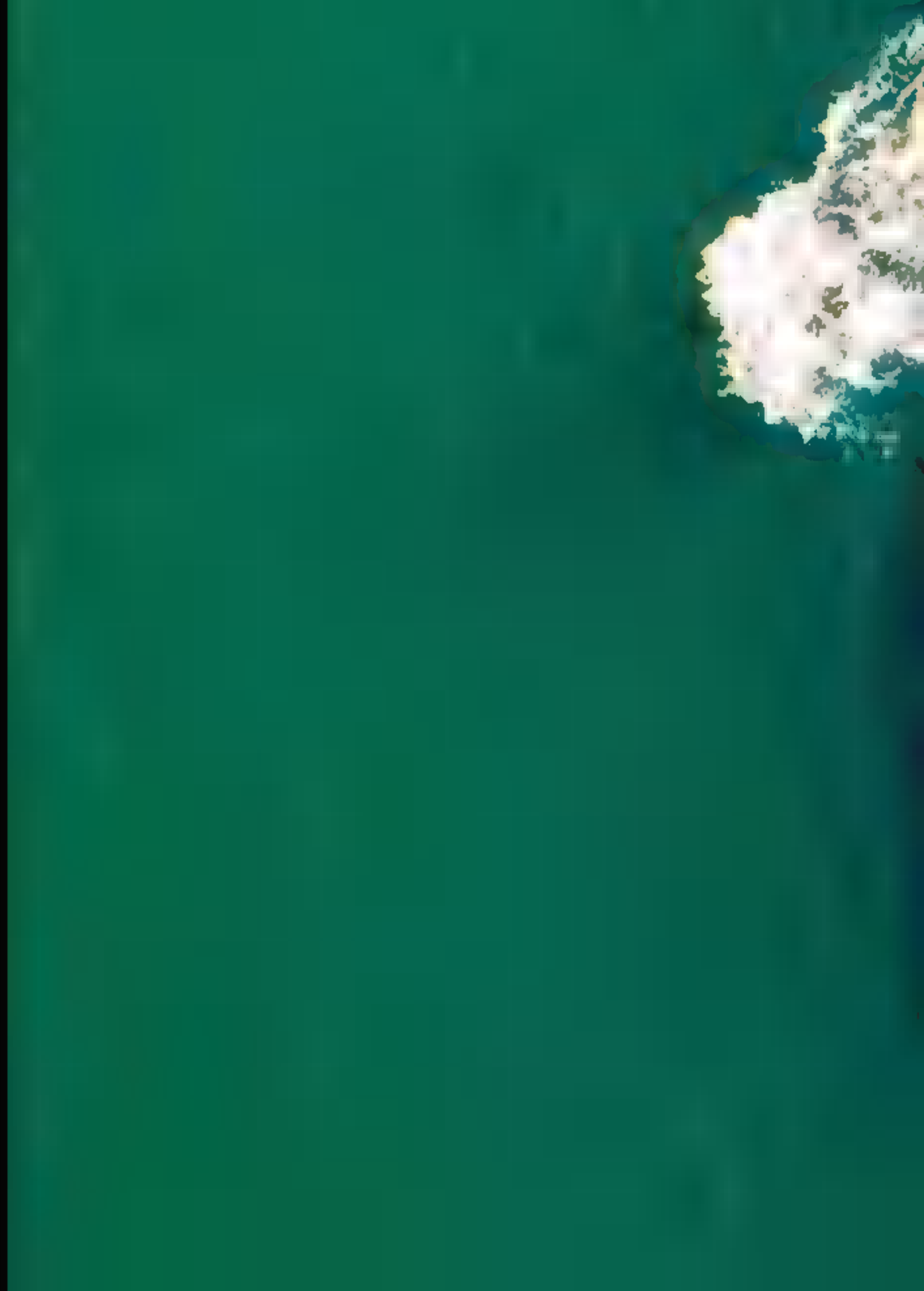
Just a few hundred these giants

survive along coasts America their

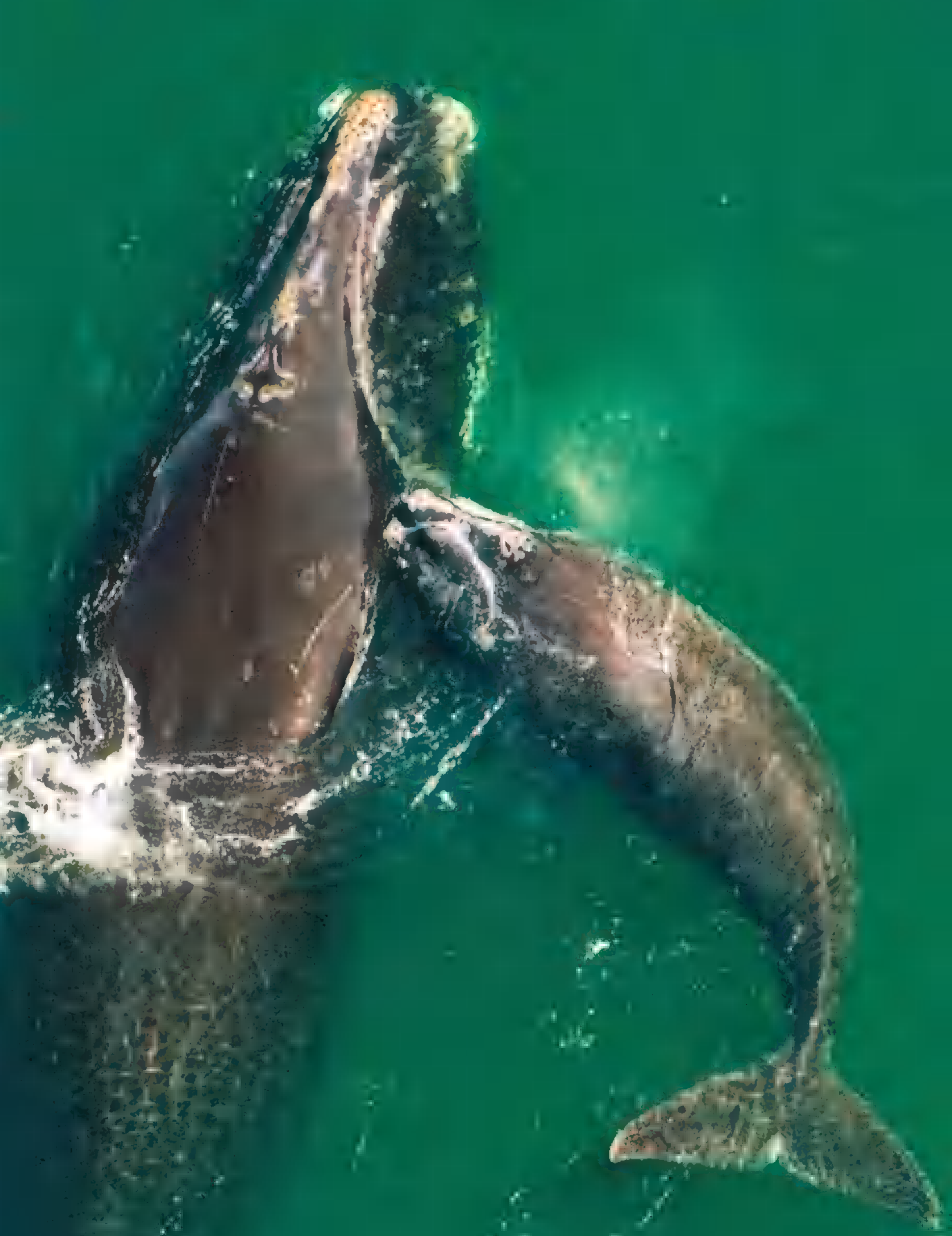
numbers are growing in southern

from busy ship lanes a 40-foot southern right whale swims safety near the remote Auckland Islands.

NORTH ATLANTIC FEMALES MIGRATE BETWEEN FEEDING GROUNDS IN THE GULF OF MAINE AND CALVING AREAS OFF GEORGIA AND FLORIDA—ROUGHLY 1,400 MILES ONE WAY—TRAVELING THROUGH ONE OF THE MOST URBAN STRETCHES OF OCEAN ON THE PLANET.



A female gets a playful bump from her new calf in warm shallows near Florida's Amelia Island. North Atlantic right whale mothers give birth and spend winters off the south Georgia–north Florida coast.



BY DOUGLAS H. CHADWICK

PHOTOGRAPHS BY BRIAN SKERRY

They dive 600 feet, brushing their heads along the seafloor with raised, wartlike patches of skin, sometimes swimming upside down, big as sunken galleons, hot-blooded and holding their breath in cold and utter darkness while the greatest tides on Earth surge by. Then they open their cavernous maws to let the currents sweep food straight in. This is one way North Atlantic right whales feed in the Bay of Fundy between Maine, New Brunswick, and Nova Scotia. Or so the experts suspect, having watched the 40- to 80-ton animals surface with mud on their crowns. Mind you, they say, that could result from another activity—one nobody can imagine yet.

Science calls these animals *Eubalaena glacialis*, "good, or true, whale of the ice." Heavy irony is embedded in the common name, right whale, given by whalers who declared them the right whales to kill. Favoring shallow coastal waters, they passed close to ports, swam slowly, and often lingered on the surface. Such traits made them easy to harpoon, and they tended to conveniently float after they died, thanks to their exceptionally thick blubber layer, which whalers rendered into oil. The first of the great whales to be hunted commercially, *E. glacialis* lit the lamps of the Old World from the Dark Ages through the Renaissance. By the 16th century Europeans had exhausted the eastern North Atlantic population and turned to North America's coast. There whalers set up stations in Labrador and took 25,000 to 40,000 related bowhead whales along with an unknown number of rights (records seldom distinguished between these two similar looking titans).

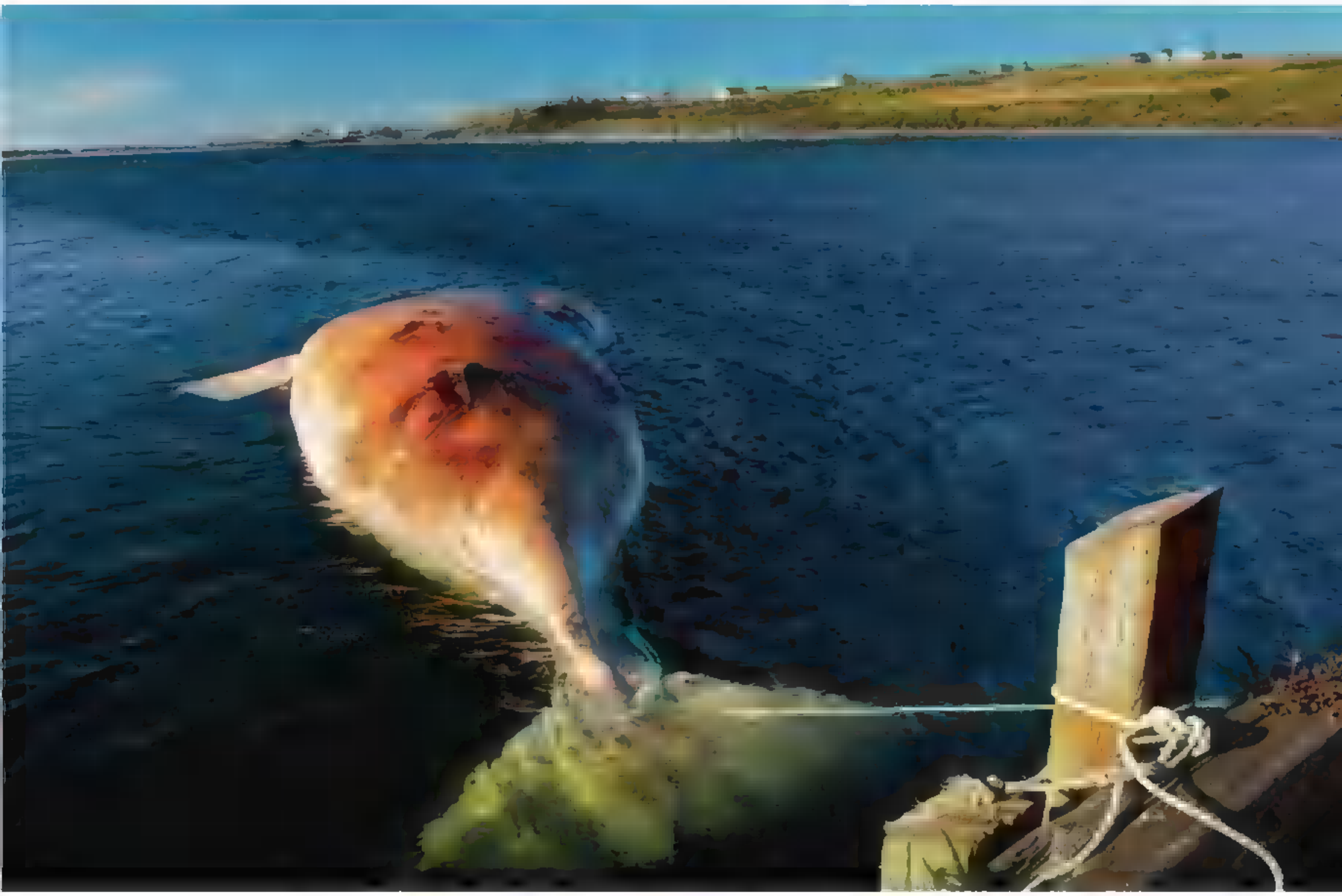
By the time New Englanders got into the right-whale-killing business, they were chasing leftovers. The Yankees hunted down another 5,000 or so, partly because whales became even more prized for their baleen than for oil. Hundreds of strips of this tough yet flexible material, each six to nine feet long and finely fringed, drape from the upper jaw. They form a colossal sieve that allows the giants to strain tiny crustaceans from the water for food—a billion flea-size copepods a day to supply the minimum 400,000 calories an adult whale needs (the ratio of a whale's body mass to its prey's is 50 billion to one). Society, however, thought baleen was best used for corset stays, stiffeners in fashionable gowns, umbrella ribs, and (consider: "I'm going to whale on you!") horsewhips.

As the 20th century began, the number of whales left in this species was possibly in the low dozens. Commercial harpooning wasn't banned until 1935. Their recovery since then might be compared to that of a human victim of a vicious assault: painfully slow progress, offset by relapses, with the ultimate outcome very uncertain.

ABOUT 350 TO 400 NORTH ATLANTIC right whales exist today. The survivors migrate along North America's East Coast between feeding grounds in the Gulf of Maine and wintering sites farther south—roughly 1,400 miles one way for pregnant females that journey to traditional calving areas off Georgia and Florida. They travel through an intensely urban stretch of ocean.

A research team from Boston's New England Aquarium spends the summer stationed in Lubec, Maine, studying the whales that gather to feed and socialize in the Bay of Fundy and nearby Roseway Basin, off Nova Scotia's southern tip. The scientists, who have built an archive of around 390,000 photographs, can recognize nearly every whale in the population by its unique callosity pattern (those wartlike patches on their heads), along with scars and other irregularities, and, increasingly, DNA samples.

One of their favorites is #2223, first seen in these waters in 1992. It was a baby, and so fond



The carcass of ■ female killed by a ship collision (tethered for study in a Nova Scotia cove) also signals the loss of all the calves she might have borne. Scientists say preventing just two deaths of adult females a year could save the North Atlantic species.

of cavorting around boats that they named it Calvin after the mischief-loving cartoon kid. That same year a fisherman reported a calf circling its dying mother, and when the team recovered the carcass of the female, they identified her as #1223—Delilah, Calvin's mom. Her corpse revealed tissues crushed by a powerful collision, probably with one of the cargo carriers plying the shipping channel that used to run straight through the bay's center, where the whales concentrate. The eight-month-old calf's prospects looked grim, for it should have been nursing Delilah's rich, warm milk for several more months.

In July 1993 researchers poring over fresh photos from the bay found images that looked like a match for Calvin's baby pictures. Yes! The orphan had somehow made it alone. DNA from a skin sample taken in 1994 showed that curious, hardy Calvin was in fact a girl whale. The following year brought the first report of her entering a surface-active group, or SAG, in which both sexes mingle with splashing, shoving, rolling, stroking signs of courtship. Though she wouldn't mature sexually until about ten years of age, subadults her age appear drawn to the excitement of SAGs and get to practice behavior that may soon influence their breeding

success. Fertile adult females are the most valuable segment of the population. They number fewer than a hundred. Calvin seemed on the verge of adding one more to their ranks.

For three years running, the researchers gauged the young female's blubber thickness with ultrasound. It's a tricky operation. "One whale's reaction jolted the skiff hard enough to send me flying overboard," Amy Knowlton of the research team recalled. Nevertheless, the researchers found Calvin growing pleasingly plump, a prime measure of health. On New Year's Eve of 1999, she was recorded for the first time in the Georgia Bight, an expanse of shallow coastal waters off Georgia and Florida, where right whales give birth.

In summer of 2000 Calvin was once again in the Bay of Fundy, but this time she was snarled in fishing gear. Unbreakable polyblend ropes wrapped round her body, cut into the skin, and trailed in her wake, slowing her down. Then researchers lost sight of the young female.

Two to six right whales are found dead in a typical year, at least half of them killed by ship strikes or entanglement. Additional animals simply disappear. Since more than three-quarters of North Atlantic right whales bear scars from encounters with fishing gear, scientists wonder: How many of those missing are weighed down by ropes, nets, or crab and lobster pots for months or even years, the fat reserves that help keep them buoyant dwindling as they starve, fighting harder to reach the surface for each breath, until they finally give in to pain and exhaustion and sink?

Months dragged by. Someone finally spotted Calvin in Cape Cod Bay during her hobbled journey back south. A disentanglement team from nearby Provincetown, Massachusetts, raced for the site and made two attempts to slice away her bindings. They couldn't get them all, but when Calvin was seen during 2001, she had worked free of the remnants.

Three years passed, and Calvin showed up

MAKING A HOME IN DANGEROUS WATERS

North Atlantic right whales run a gantlet of ships, nets, and lines as they swim through a bustling maritime corridor, feeding, giving birth, and raising young. Conservationists say limiting vessel speeds to ten knots in key areas when whales are present would cut ship-strike mortality dramatically. Researchers are also working to develop fishing lines that would break rather than entangle and kill whales. Preventing all human-caused deaths could swell the population an estimated 25 percent within 15 years.

occasionally—but not in her usual summer haunts. Had the trauma sent her into a downward spiral? At the end of December 2004, near the North Carolina coast, she presented herself—with a brand new calf. Seven months later, in 2005, they were in the Bay of Fundy, where Delilah had brought Calvin as an infant.

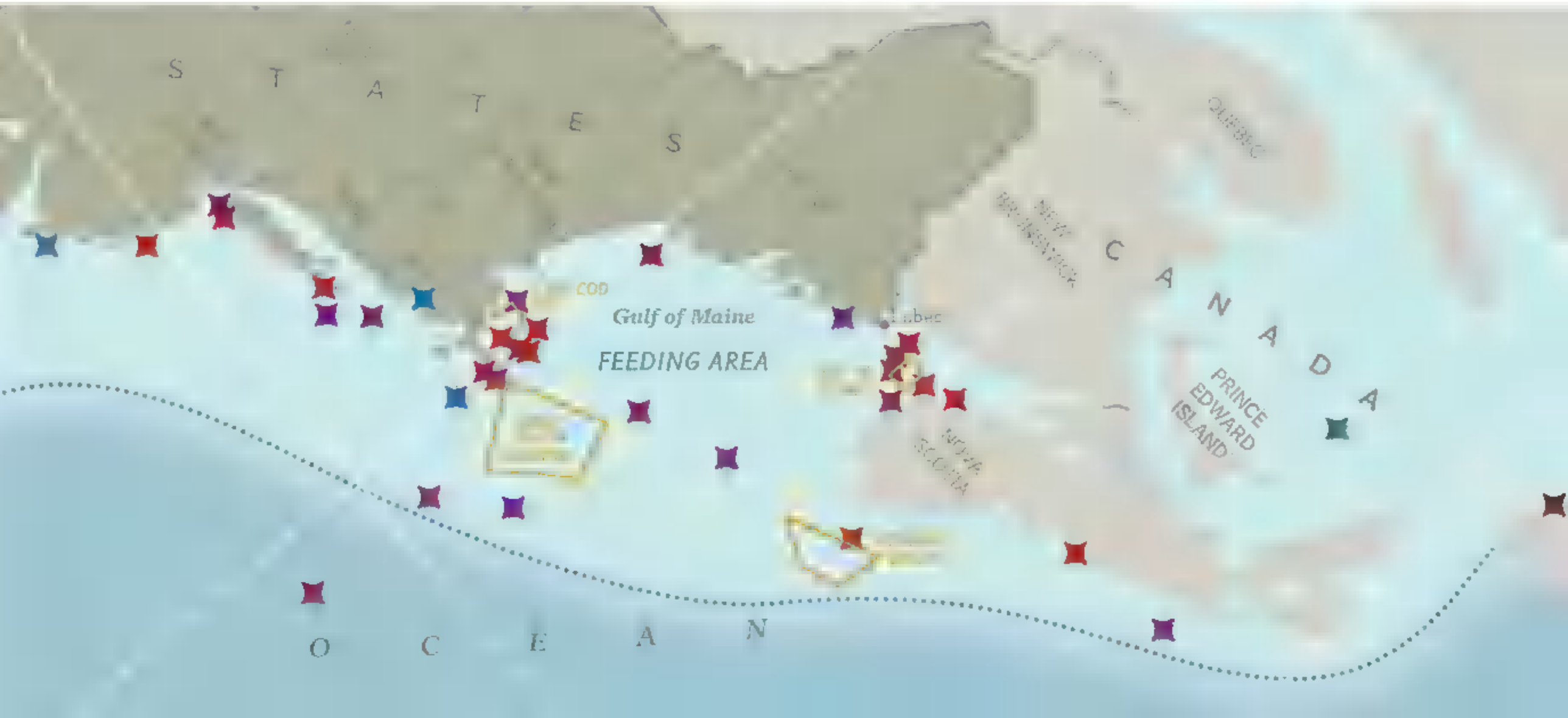
THE CORRIDOR TRAVELED by Calvin and the other North Atlantic right whales has grown ever more crowded with fishing activities and busy shipping lanes. Plumes of contaminants flow from river mouths, and the underwater din of ship traffic probably makes it increasingly difficult for the whales to communicate and keep track of one another. Though not as visible as wounds from boat prows and propeller blades or fishing gear webbed around struggling bodies, heavy chemical and noise pollution may take a gradual toll.

During the 1980s the number of babies born annually was around 12. The total twice fell sharply in the 1990s until just a single calf appeared in 2000. Since then, the average has risen to more than 20 calves a year. Yet this remains 30 percent below the whales' potential rate of reproduction. Why? If scientists are to guide the species' salvation, they need more data and more answers. Fast.

One August morning in 2006, when the sea was a sheet of dimpled satin shot through with silver threads, I joined Scott Kraus, the New England Aquarium's vice president of research, and Rosalind Rolland, a veterinarian and senior scientist with the aquarium, on an unlikely quest in the Bay of Fundy. When leviathans rose in the distance through the sea's shimmering skin, Kraus steered the boat downwind of where they had briefly surfaced, handed me a data sheet to log our movements, and zigzagged into the faint breeze. Rolland moved onto the bow. Beside her was Fargo, the world's premier whale-poop-sniffing dog.

Fargo began to pace from starboard to port,

Species	Southern	North Pacific	**North Atlantic**
1600s	55,000-75,000	10,000	**10,000**
Present day	10,000	100-600	**350-400**



nostrils flaring. Rolland focused on the rottweiler's tail. If it began to move, it would mean he had picked up a scent—and he could do that a nautical mile away. Twitch… Twitch… Wag, wag. "Starboard," Rolland called to Kraus. "A little more. Nope, too far. Turn to port. OK, he's back on it." A quarter of an hour ran by like the bay's currents. All I saw were clumps of seaweed. Suddenly, the dog sat and turned to fix Rolland with a look. We stopped, and out of the vast ocean horizon came a single chunk of digested whale chow, bobbing along mostly submerged, ready to sink from view or dissolve altogether within minutes.

Kraus grabbed the dip net and scooped up the fragrant blob. You'd have thought he was landing a fabulous fish. "At first, people are incredulous. Then come the inevitable jokes. But this," said the man who has led North Atlantic right whale research for three decades, "is actually some of the best science we've done."

THE COMMON NAME, RIGHT WHALE, WAS GIVEN BY WHALERS WHO DECLARED THEM THE RIGHT WHALES TO KILL.

With today's technology, DNA from sloughed-off intestinal cells in a dung sample can identify the individual that produced it. Residues of hormones tell Rolland about the whale's general condition, its reproductive state—mature? pregnant? lactating?—levels of stress, and presence of parasites.

DESPITE ITS LOW NUMBERS, the North Atlantic right whale may not be the rarest of all the great whales. There may be no more than a few hundred North Pacific right whales, *Eubalaena japonica*, which were harpooned illegally by Soviet whalers as late as the 1960s. But on the other side of the Equator, the southern right whale, *Eubalaena australis*, has rebounded from a few hundred in the 19th century to at least 10,000. If its cousins along North America's East Coast are the urban whales, these giants of the Southern Hemisphere are the wild whales, and they offer a vision of what a safer future might be like for the other two right whale species.

After feeding in plankton-laden waters around Antarctica, the various populations of *E. australis* migrate to wintering areas near Argentina, southern Africa, western and southern Australia, and sub-Antarctic New Zealand. The species has been increasing at a rate of up to 7 percent annually. That's close to the maximum possible for whales that require a full year for pregnancy, devote at least one more to nursing, and another to fatten up, and therefore can produce an offspring only every third year.

In July 2007 Rolland, Kraus, and I joined a team bound for the Auckland Islands, 300 miles south of New Zealand through some of the planet's stormiest latitudes, to carry out census and DNA work. As our 82-foot sailboat *Evohe* slipped into a protected bay amid the isles, there was nothing but sunshine washing the deck. Then, like explorers of a bygone era, we watched natives paddle across the water to surround our vessel. Except these natives paddled with flukes and blew spray from their heads.

Curious right whales investigated *Evohe* for hours while yellow-eyed penguins leaped along like skipping stones beside them. Great breaths overrode the sounds of waves and seabird cries and the mewling of young New Zealand sea lions from rookeries ashore. More whales milled and breached for as far as we could see. They were bigger than northern rights. More than one in ten were pinto-patterned, flashing yards of smooth white skin. A bygone era? This was beginning to feel more like the dawn of creation. Rolland and Krause, who had never viewed a southern right before, were beside themselves.

"Omigod. That one right there is the fattest young whale I have ever seen." (When judging the condition of northern rights, the scientists pay special attention to the area just behind the blowhole, where the chubbier animals develop a

A calf's open jaws reveal a pink soft palate that releases excess body heat, and a hanging sieve of baleen that strains tiny prey from the sea. Unique to right whales, rough skin callosities develop in patterns that identify individuals as clearly as fingerprints.

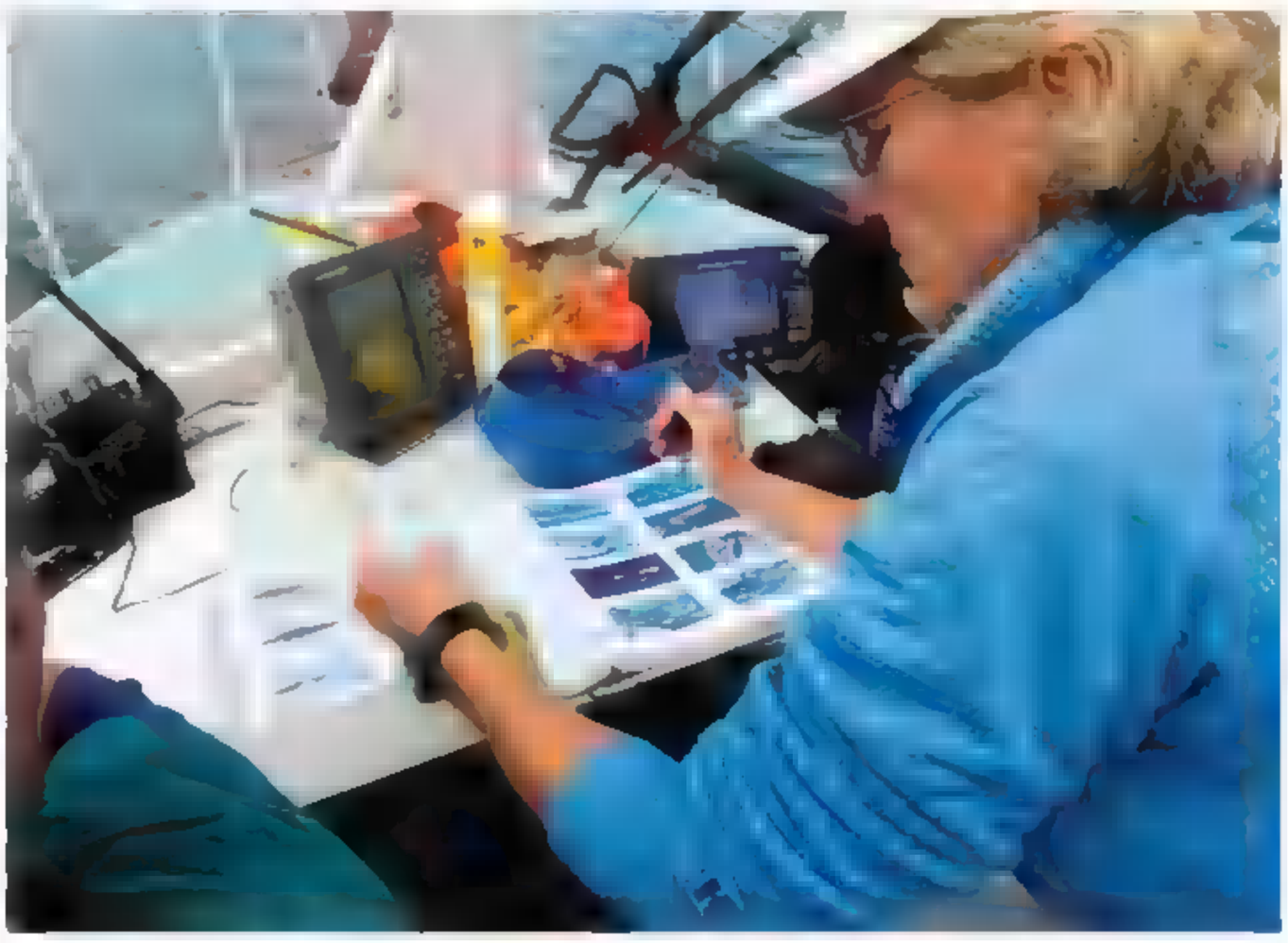
bulge of blubber. Its size has proved to be an accurate predictor of survival.) "We don't even have a category for a whale with a fat roll that big."

"They're so clean! Not a mark on them."

Over the next three weeks, hundreds arrived in succession to give birth and nurse pale-colored infants or churn the water in SAGs and compete for mates before heading back to the open sea. Gales blew from all directions—this was midwinter in the Southern Hemisphere—coating the hillsides with snow. Researchers beat through the waves in a skiff to take identification photos and collect skin samples with small, hollow-tipped darts so they could define the genetic makeup of this recovering population more closely. Glenn Dunshea, from Australia's Center for Applied Marine Mammal Science, was interested in telomeres—DNA sequences at the tips of chromosomes that gradually shorten throughout an animal's life. By studying them in right whales, which may live at least the better part of a century (their close cousins, bowheads, may reach two), he hopes to discover more about telomeres' role in the aging process. Wouldn't it be humbling if a map to the legendary fountain of youth lay hidden within creatures we almost exterminated?

Kraus and Rolland roamed in a second skiff to

Scars on this adult in the Bay of Fundy likely resulted from entanglement in fishing gear that cut through the skin. Tracking North Atlantic rights in their summer feeding grounds helped scientists like Moira Brown of the New England Aquarium (right) convince Canadian officials to shift the Bay of Fundy shipping lane four nautical miles east in 2003, reducing the likelihood of ship collisions by 80 percent.



view and photograph the whales in order to conduct detailed visual health evaluations, which they could compare with those of troubled whale populations back home. They wore their usual happy-to-be-in-the-kingdom-of-giants glow, yet it was mixed with a touch of sadness. As Rolland put it, "We just saw more right whale calves in two hours than people will see all year in the whole North Atlantic."

SAFEGUARDING WILDLIFE, even in the globe's most remote places, gets harder all the time.

The southern whales are doing fine for now, but keeping them that way will require better protection of critical wintering areas and migration routes. Fishing gear drowns so many diving seabirds in far southern waters that several kinds of albatrosses are in desperate trouble. As fisheries and whale populations both expand, conflicts with whales can't be far off.

As for the whales of the North Atlantic, commercial fishing and marine transport are huge, vital industries, and modifying their operations along the entire eastern seaboard to protect a few hundred giants won't be easy or cheap. Yet scientists' models say that saving just two sexually mature females each year from being killed would change the trend for this endangered species from either downward or level to upward.

Posed that way, the problem doesn't sound so hard to solve. A network of aerial and vessel surveys augmented by a force of volunteers who keep a sharp eye out for these warm-blooded submarines stands ready to help.

The volunteer force includes fast-striding beachcombers, folks who gather for morning coffee and then drive from one overlook to the next, and residents who watch from the windows of their condos. There are also the few, the proud…the vertical team. They take elevators to the tops of the tallest buildings around and scan the ocean from a seagull's perspective.

Still other whale trackers take to the air. Volunteer pilot George Terwilliger flew the scientists who saw mothers and calves in the Georgia Bight in 1984; before then no one knew where the last of the North Atlantic right whales went to give birth. Terwilliger still flies two to three times a week, piloting an Air Cam aircraft specially designed for low-speed reconnaissance and photography.

Whether a surfacing whale is spied from shore, roof, or sky, the information is quickly phoned in via hotline to the Early Warning System, which transmits it to military and commercial mariners. When operators of commercial vessels over 300 gross tons enter right whale habitats, they must notify a Mandatory Ship Reporting System, which automatically provides information about recent sightings.

It's far from a perfect strategy. Ship captains don't have to slow down if they don't feel like it. The federal government recently cut funding for right whale conservation research. But nothing seems to dampen the volunteers' enthusiasm.

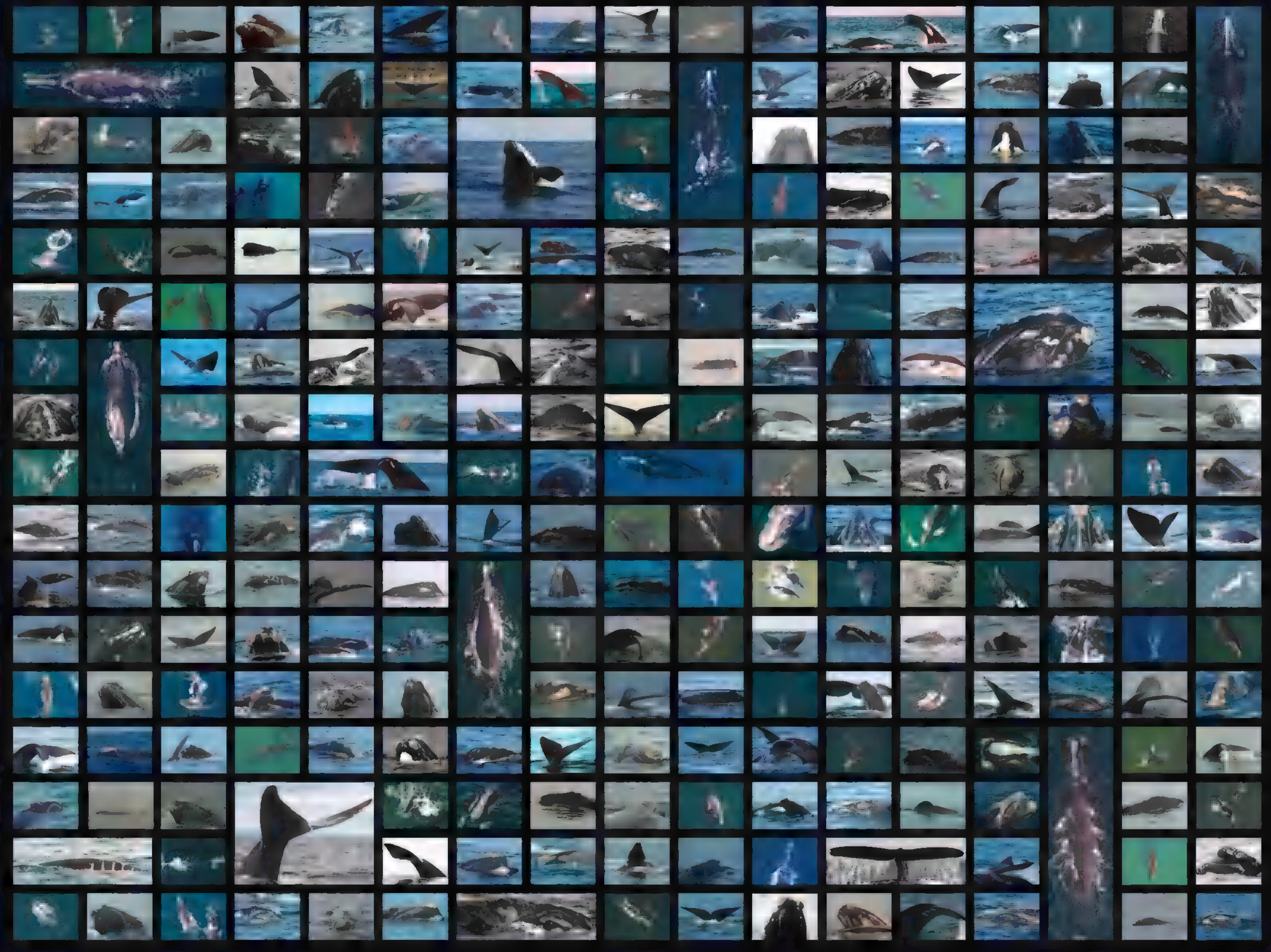
FARGO, THE WORLD'S PREMIER WHALE-POOP-SNIFFING DOG, COULD PICK UP A SCENT A NAUTICAL MILE AWAY.

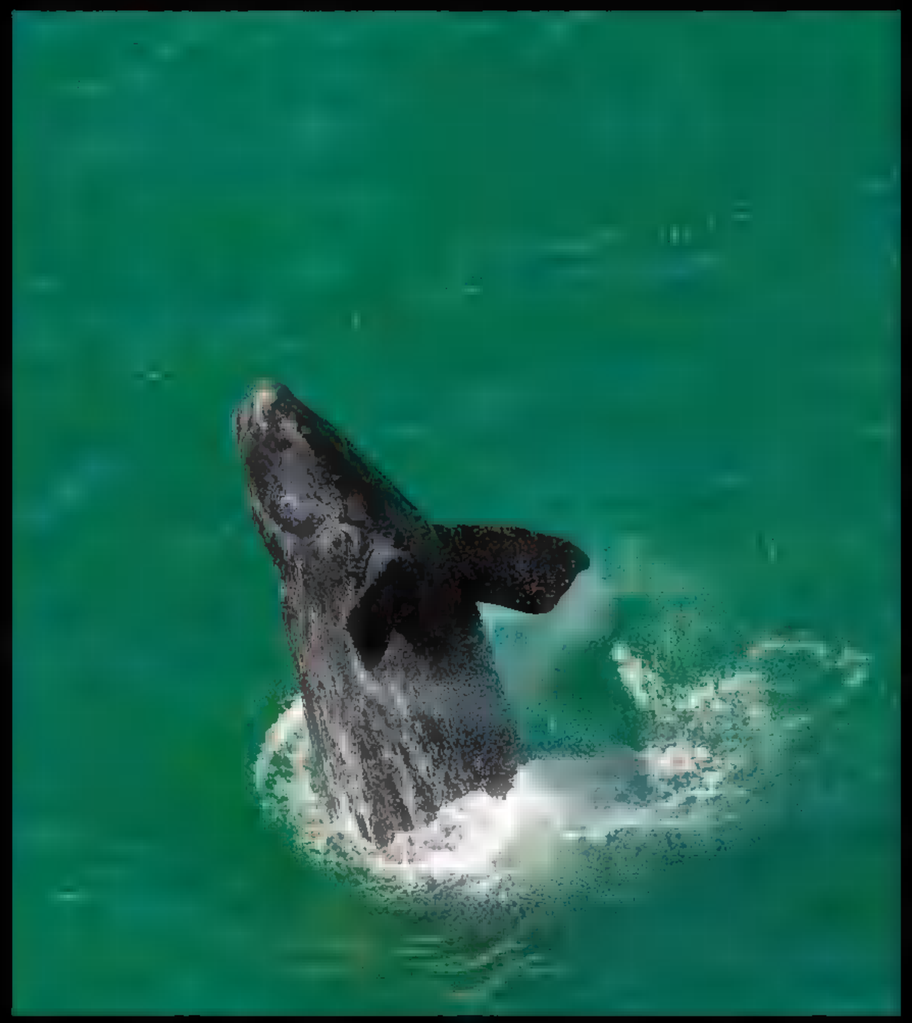
Standing on the boardwalk of a gated community in Florida, binoculars at the ready, Donna McCutchan said, "Most people in this development were like me. They had no idea whales winter here. Now everybody knows about them, and they know to call in if they spot one." McCutchan herself hadn't seen a whale for weeks. She didn't mind waiting, she said. "I once got to watch a mother roll onto her back, and bottlenose dolphins started jumping over her. Whales are addictive. Once you see them, you don't want them to leave. Ever."

Doug Chadwick and Brian Skerry, between them, have reported on creatures from beetles to snow leopards to sharks to whales—to name just a few.

FAMILY ALBUM Admiral displays her tail straight up like a sail. Radiator bears scars that run in parallel lines. An individual animal's unique markings are recorded on schematic drawings (left), and researchers follow their movements like parents watching children. Every whale counts, since the population grows by only 1 to 2 percent a year. Researchers are unsure why the North Atlantic species' birthrate is so low but suspect that stresses related to living in an industrialized coastal zone contribute. The U.S. has recognized these whales as endangered since 1970, and they continue to teeter on the edge of extinction.

PHOTOS COURTESY NORTH ATLANTIC RIGHT WHALE CONSORTIUM, COLLECTED UNDER PERMITS ISSUED BY NMFS/OFFICE OF PROTECTED RESOURCES. BY HAMILTON, NEW ENGLAND AQUARIUM

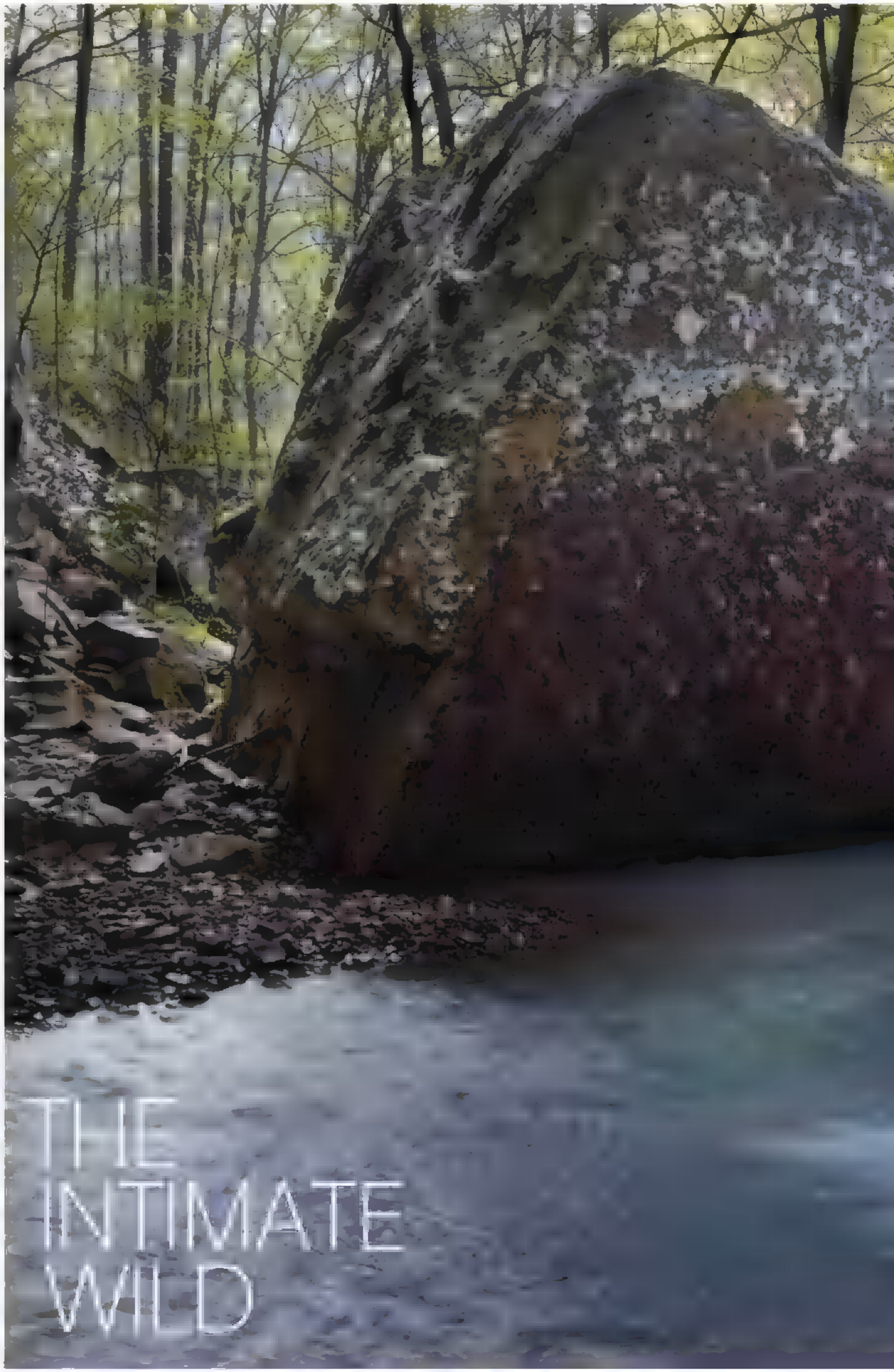




A SPECIES IN YOUR HANDS

On three pages (overleaf) appear pictures of every one of the 359 North Atlantic right whales old enough to be individually identified, assembled from an archive of photographs that documents all known members of the species. Whales younger than about eight months are still developing their distinctive markings, and like the calf breaching off the coast of Florida (above), they can be visually distinguished only by their close association with their mothers.

The Auckland Islands Marine Reserve protects an area 300 miles south of New Zealand's South Island, where these two robust southern rights are part of a recovering population thought to include more than 1,000 whales.



OZARK HIGHLANDS TRAIL

BY MEL WHITE | PHOTOGRAPHS BY PETER ESSICK

A gossamer veil of mountain runoff curtains a pool at Pam's Grotto—one of hundreds of waterfalls visited by the Ozark Highlands National Recreation Trail. Traversing Arkansas's northwest corner, the little-traveled path reveals the region's untamed heart.

A crackling spring storm marches over the undulating landscape. Thickly forested with red oak and black gum, these hillsides have witnessed much history, having been roamed by Indians, crisscrossed by Spanish and French explorers, and skirmished over by Union and Confederate armies in the Civil War.

Friends warm up by a campfire after a day of splashing through creeks. "You can pretty much camp anywhere," says Tim Ernst, one of the trail's pioneers.

THE VIEW FROM THE BLUFFS atop White Rock Mountain has changed hardly a whit in thousands of years. The nearly unbroken forest of the Arkansas Ozark Plateau disappears at a horizon that may be 40 miles away, beyond ridges and valleys numberless as ocean waves. If you could speed up a video of past millennia, you would see fires and storm blowdowns and logging by the settlers who came and, mostly, went. But when the clock returned to today, you would see what the Osage Indians saw.

White Rock lies at milepost 18 of the Ozark Highlands National Recreation Trail, a 165-mile-long hiking route that crosses a considerable part of northwestern Arkansas, mostly through the 1.2-million-acre Ozark National Forest. The vista from the top is among the best in the Ozarks, which makes it de facto one of the best between the Appalachians and the Rockies. Nonetheless, people who know and love the trail generally don't talk about its views, fine as they are, when they describe what they find most appealing about it.

They talk about waterfalls and rocky creeks that surge with every rain and retreat in summer to serene, solitary pools that tempt even the most prudish to skinny-dip. They talk about rock formations like chaotic sculpture gardens and hillsides profligate with trillium and trout lilies. They talk about the way most every mile changes with the seasons, from the white explosions of serviceberry and dogwood in spring to the reds and oranges of black gum and maple in fall to winter leaf-off, when sight lines open to landscapes hidden the rest of the year behind relentless greenery.

"It's the intimate scenery that sets this trail apart," Tim Ernst says, relaxing in a spot that demonstrates just what he's talking about. He leans back against a sandstone bluff, under tall beech trees, in a compact valley (a "holler," locally) where the loudest sounds are the companionable twitterings of chickadees and kinglets and the patter of water falling over a two-foot ledge in the creek below. A sycamore leans beside the stream, its white trunk reflected in the water. On the hill above stand pines two people can barely join hands around.

Without the efforts of people like Ernst, this beauty and solitude might be out of reach. The Ozark Highlands Trail ranks among the longer

Sandstone outcrops jut from the Ozark hillsides, remnants of a vast primordial inland ocean that covered the region some 350 million years ago.

of the country's more than a thousand official National Recreation Trails. Created by the National Trail System Act of 1968, this network of routes has grown to include segments in all 50 states (see pages 138-39). Yet despite the federal designation, Ozark Highlands and many other trails depend largely on volunteers, who often struggle to create, fund, and maintain their adopted pathways.

If Ernst isn't the Ozark Highlands Trail's father, he's undoubtedly its longtime foster parent. The trail was established by the Ozark National Forest in the granola-fed 1970s, when "John Denver was singing about Colorado, and everybody was wearing wafflestompers," as Ernst says—a time when backpacking and canoeing got tens of thousands of Americans out on trails and rivers. By the Reagan-era eighties, though, U.S. Forest Service budgets had shrunk, and the barely begun Ozark Highlands Trail needed help if it was to be completed.

Ernst had grown up hunting in the Ozark National Forest. Later, in college, he took long bushwhacking hikes through the backcountry. "I didn't have a clue what I was doing," he says. "I was wearing plain 100 percent cotton socks, and I had a Wal-Mart pack or something. I had blisters on my feet, and I was miserable the whole time, at least physically." But he fell in love with backpacking and with the sections of the trail that had been completed.

When construction on the trail stalled, Ernst called a meeting in his hometown of Fayetteville, Arkansas. "My goal was to find out if we could have a handful of people who could take over maintenance of what was out here, and then maybe build a little bit every now and then. We had 50 people show up at the first meeting, and that's how the Ozark Highlands Trail Association got started."

Over time the all-volunteer OHTA, almost entirely under Ernst's leadership, grew to more than 400 members in two dozen states. The group completed the trail in 1984 and, with members "adopting" two- to seven-mile segments, has continued to maintain it.

"The layout of the trail is good because hikers did it," Ernst says. "That's why I say this

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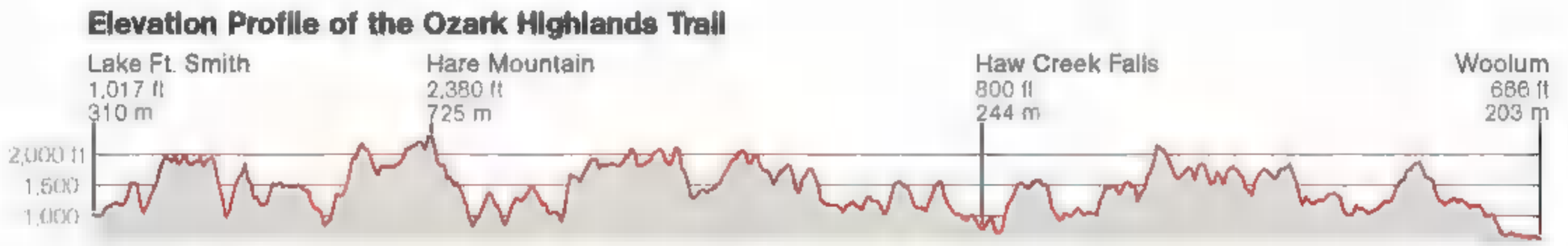
Mel White, who lives in Little Rock, Arkansas, last wrote about the Philippine eagle. Peter Essick photographed "High-Tech Trash" in the January 2008 issue.

"THE LAYOUT OF THE TRAIL IS GOOD BECAUSE HIKERS DID IT," TIM ERNST

is a handcrafted trail. It was built by people who weren't experts when we started, but got expert in a hurry. We built the trail that we wanted, the way we wanted it. In those early days we simply went out on weekends and bushwhacked. We walked drainages, walked ridgetops. We looked around and asked ourselves, What's down there?"

At milepost 54, the Forest Service had proposed that the trail run along an old road to save construction costs and effort. Ernst and his team scouted around a bit and discovered a wonderfully picturesque holler now known as the Marinoni Scenic Area. "I told the Forest Service, 'We have got to bring the trail through here,'" Ernst says. "They said it would be a lot more difficult to build. I said, 'I don't care how hard it is to build. That's what we're here for, is to see places like that. It's not an interstate.'"

Hikers can easily judge for themselves if the effort was worthwhile. From the Lick Branch trailhead it's only a couple of hours' easy walking west to Marinoni. (There'll be a delay where the trail winds through an amazing maze of sandstone blocks, each the size of a small RV.) After crossing the old road that was to be the trail, the path descends into a sheltered cove under big beeches, their smooth, gray bark mercifully untouched by lovesick teens and other pocketknife-carrying woods vandals.



Over the Ridges and Through the Woods

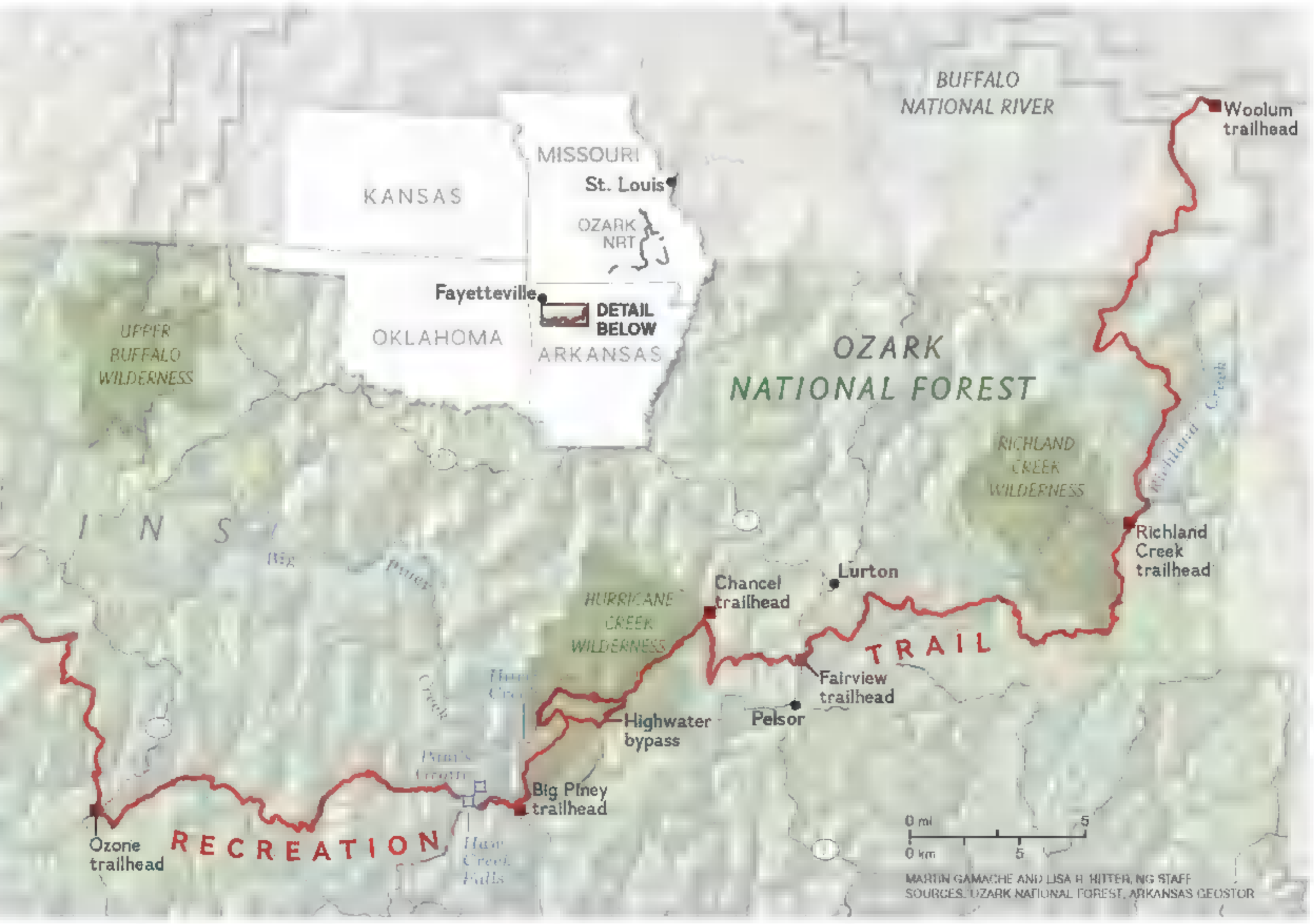
Volunteers built the last section of this 165-mile footpath in 1984. Winding across mainly federal lands, the trail leads hikers up steep ridges and down into cool, shadowed hollows. "We designed the route so people could really *feel* the terrain," says Tim Ernst, founder of the group that sustains it. In the decades since its creation, volunteers from 20 states have worked more than 350,000 hours extending and maintaining the trail.

SAYS. "THAT'S WHY I SAY THIS IS A HANDCRAFTED TRAIL."

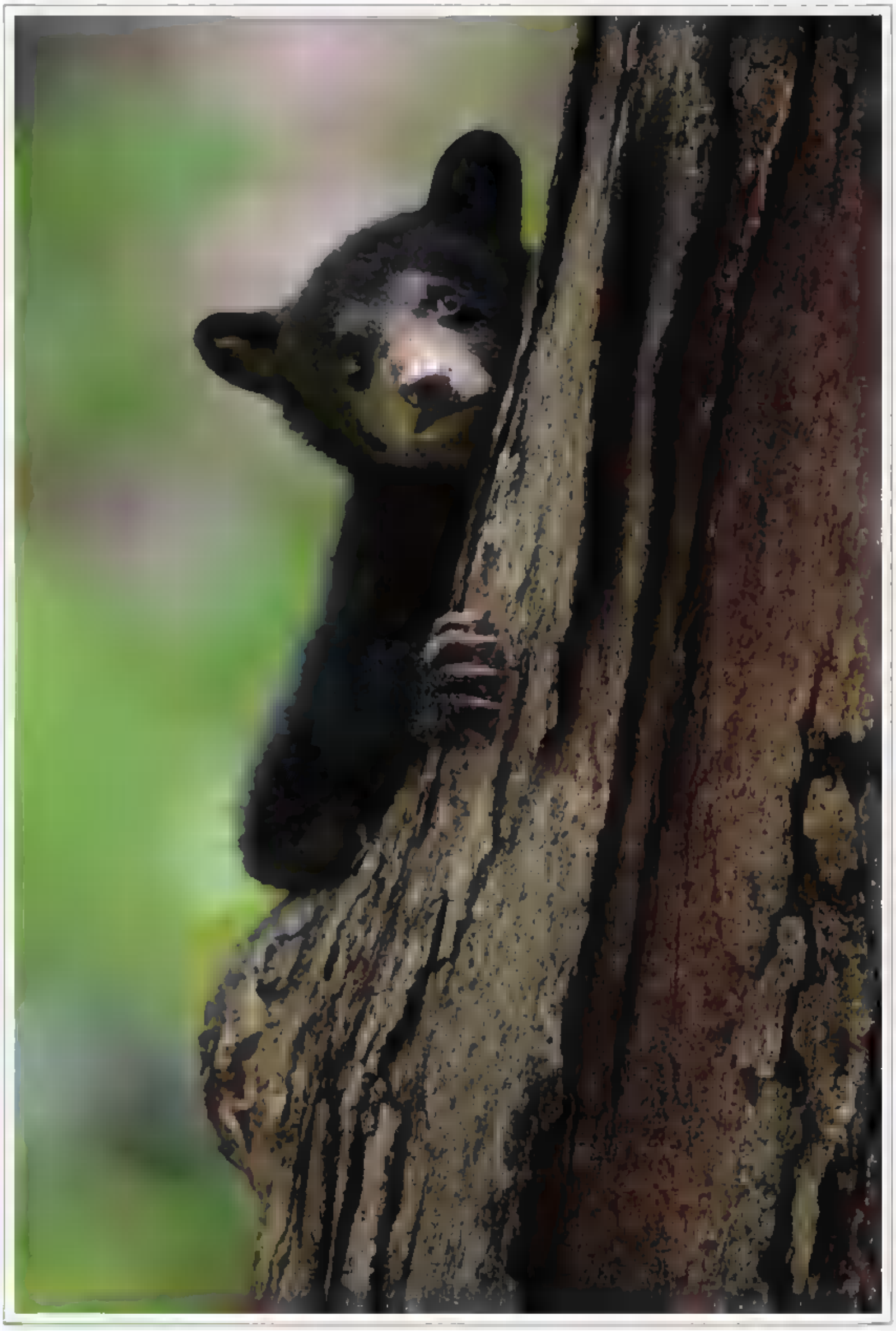
Then the real scenic area begins, as the trail reaches Briar Branch and passes bluffs dotted with wild hydrangea and the shrub with the wonderfully evocative folk name of "hearts a-bustin' with love." (That's *Euonymus americanus* to botanical types.) Down by the creek, in April, umbrella magnolias show off white flowers ten inches across. Huge sandstone boulders, shaped by eons of erosion, have the sensuously rounded shape of unfinished Henry Moore sculptures. All in all, it's not a place you'd care to miss if you happen to be in the neighborhood.

Though the Ozark Highlands Trail passes only 13 miles through an officially designated federal wilderness, the trail "has a lot of wilderness character," Ernst says. "There are no bridges, there aren't campsites everywhere. You can hike this trail from end to end and see only a couple of buildings." Here and there, though, the human history of the Ozarks region reveals itself to hikers. On Hare Mountain, at 2,380 feet the highest point on the trail, rock walls offer the first sign of an incongruous, if not outright ghostly, pre-Depression farmstead where a family once raised cotton and corn. Back in the woods, a fireplace is all that remains of their dwelling. The chimney is broken at eight feet, and the rest of its squared-off stones are scattered about, overtopped by oaks and hickories, nearly overcome by tangles of coralberry.

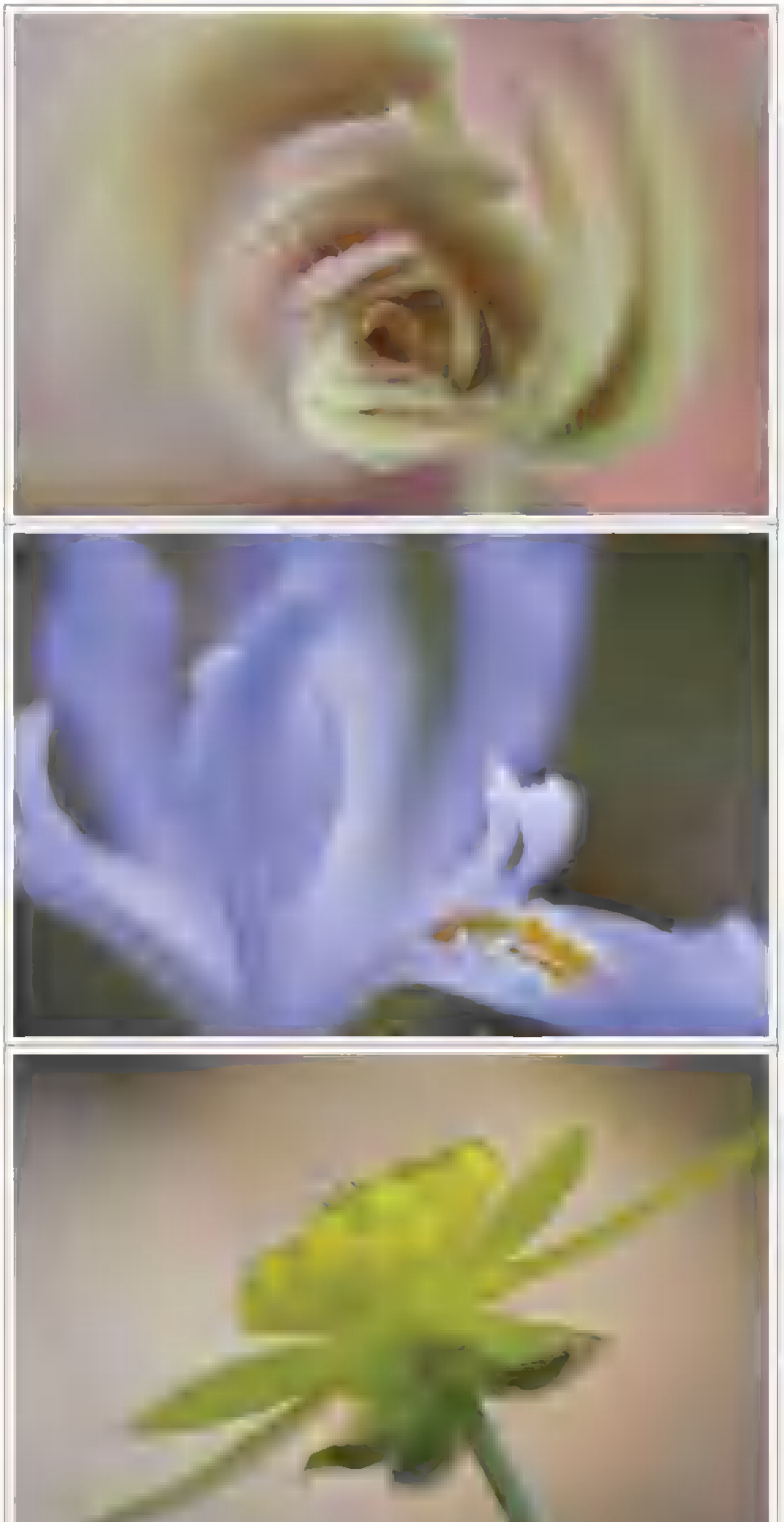
Thirteen miles west, a different sort of history provides the easiest walking on the entire trail. Here the route follows an abandoned railroad tramline for three miles, dead flat except where trestles once crossed creeks and ravines. The narrow-gauge line hauled logs out of the forest in the 1920s. Timber operations—both the old cut-and-run style and modern managed forestry—have covered every square mile of the Ozarks, leaving woodlands of varying ages but almost nothing more ancient than maturing second growth. *(Continued on page 136)*

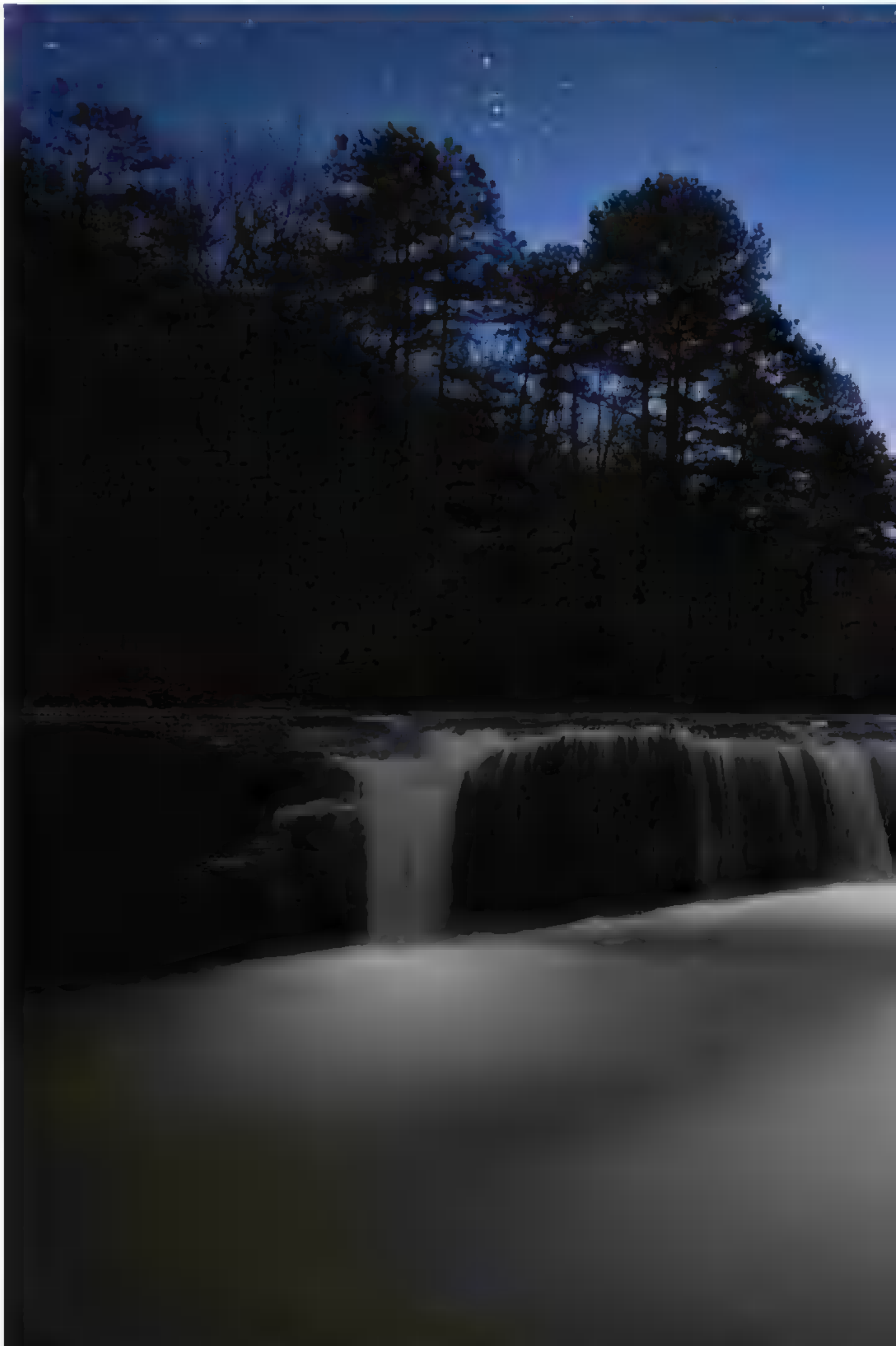


A March snow holds the trail in silent thrall—briefly. Winters in the Ozark highlands are usually mild, with few snowfalls. Hikers use the trail year-round. Photographer Peter Essick drove all night to capture a fleeting storm: "At dawn the trees were coated in thick, wet flakes. By the next day it was mostly gone."



A black bear cub peers curiously from ■ treetop perch. Indians in the Ozarks salved wounds with bear oil, though for many maladies they turned to forest plants, using shagbark hickory (top right) to cure headaches and irises (middle) to treat liver ailments. They might have avoided eating some members of the buttercup family (bottom), which modern medicine recognizes as poisonous.





Bathed in moonlight and swollen with floodwater, the rush of Haw Creek Falls announces the return of spring. To minimize maintenance, there are no bridges along the trail. "In some places you can hop from rock to rock," says Ernst. "In others you have to get your feet wet and feel how cold the water really is."

HUGE BOULDERS, SHAPED BY EONS OF EROSION, HAVE THE SENSUOUSLY

A natural arch looms over a hillside near Hurricane Creek. The trail winds past a few such sandstone structures, monuments to the power of erosion.

Three hundred million years of geologic forces have ensured that flat walking is an anomaly on the Ozark Highlands Trail. Though commonly described as part of the Ozark Mountains, this area of northwestern Arkansas and southwestern Missouri is really a series of eroded plateaus. That is, the high points weren't so much pushed up as the valleys between them were worn away by erosion, a feature apparent from any lookout: The mountains in all directions are flat-topped, and the tallest are mostly the same height, because they all started as deposits on a Paleozoic-era seafloor, transformed by geologic forces into sandstone, limestone, and shale.

Tim Ernst expresses what this means in practical terms: "Because the ridges run north and south, and the trail goes east and west, you go up and down. You see ridgetops, and you see creeks, again and again and again."

If today's hiker finds the roller-coaster trail exhausting at times, there's some comfort in knowing that it's hardly a new experience. A German adventurer named Friedrich Gerstäcker tramped through the Ozarks in the early 1840s and wrote in his journal (probably while soaking his tired feet) that the mountains "do not appear very high, because only the top of the next division is visible; but when one is surmounted, another and another arise, and people maintain that when you come to the highest there is always one more."

Ernst describes the trail as "challenging but not difficult. There are a number of thousand-foot climbs, but they're contoured so it's not steep." Experienced backpackers who cache food or arrange resupply drops can hike it end to end in ten days to two weeks, usually in solitude enough to satisfy any modern-day Thoreau, an advantage of being in a remote part of a mostly rural state. But hundreds of people use the trail for only a few hours or for overnight trips, finding as much pleasure as the fittest long-distance walker. The trail highlights—all the waterfalls, rock formations, deep hollers, and swimming holes—

ROUNDED SHAPE OF UNFINISHED HENRY MOORE SCULPTURES.

In early spring, saplings and grasses sprout, but summer's dense, sun-blocking leaf canopy will check their growth and help keep the trail clear.

can be reached in day hikes from trailheads.

While beauty and peace generally reign over the trail, it's not immune to problems or controversy. In recent years millions of red oaks in the Ozarks have died from poorly understood factors lumped under the name oak decline. To keep the trail clear, association volunteers carry chain saws, sometimes for miles, to cut fallen trees that can number dozens each year per mile of trail. In addition, a more open tree canopy lets more sunlight hit the forest floor, promoting fast-growing grasses that have to be attacked with handheld weed trimmers.

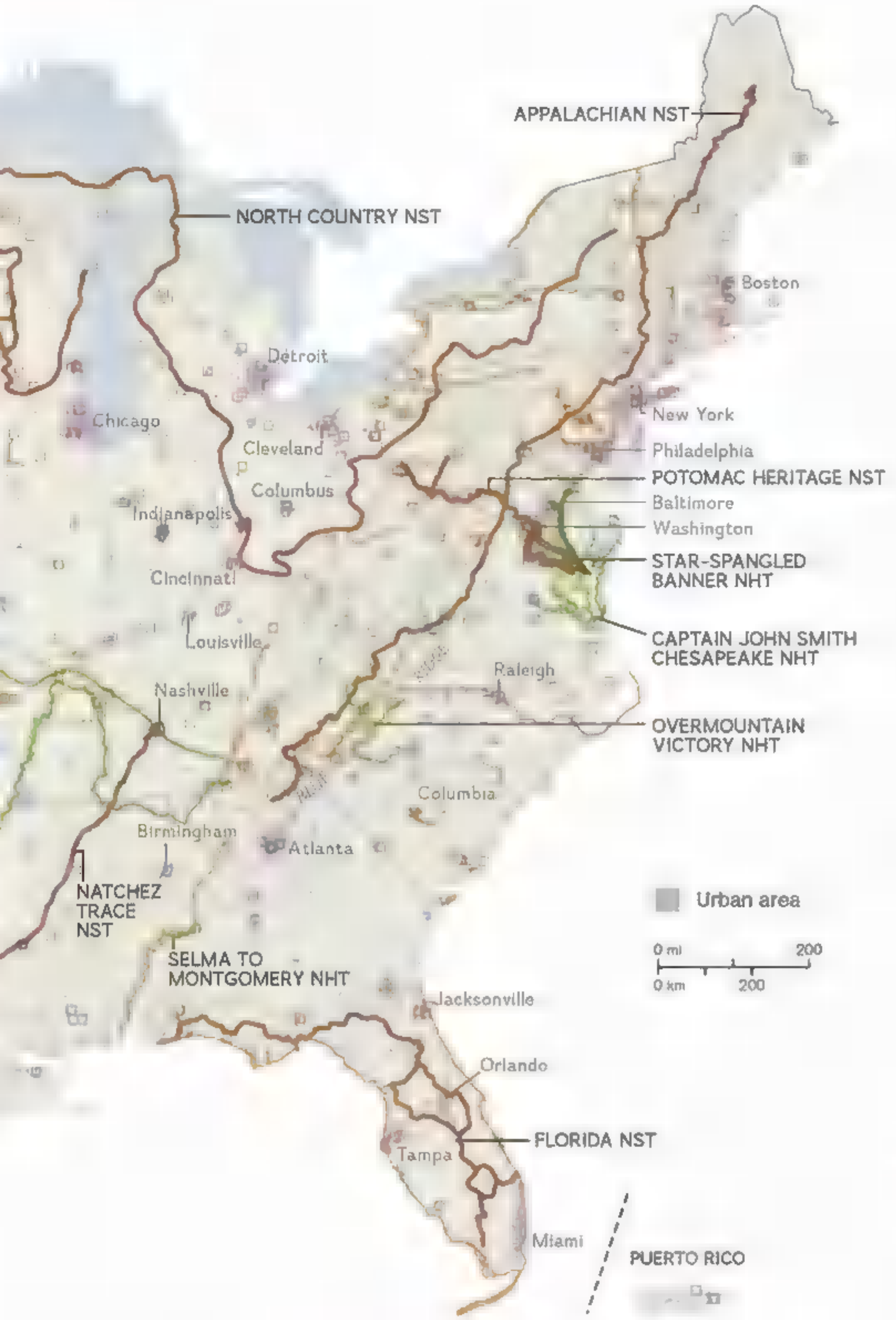
Almost from the beginning there have been plans to extend the trail northward to the Missouri state line. There it would meet the Ozark National Recreation Trail, a similarly named trail now under construction, making possible a hike from St. Louis nearly to Oklahoma. To do so, though, would require running the trail 14 miles through a wilderness area along the Buffalo National River. Though it originally supported the plan, the National Park Service later vetoed trail construction, backed by local conservation groups who want to minimize human presence in the wilderness. Ernst says he values the wild in wilderness as much as anyone, but thinks the goal of a 700-mile hiking trail across mid-America merits a 14-mile exception to the rules.

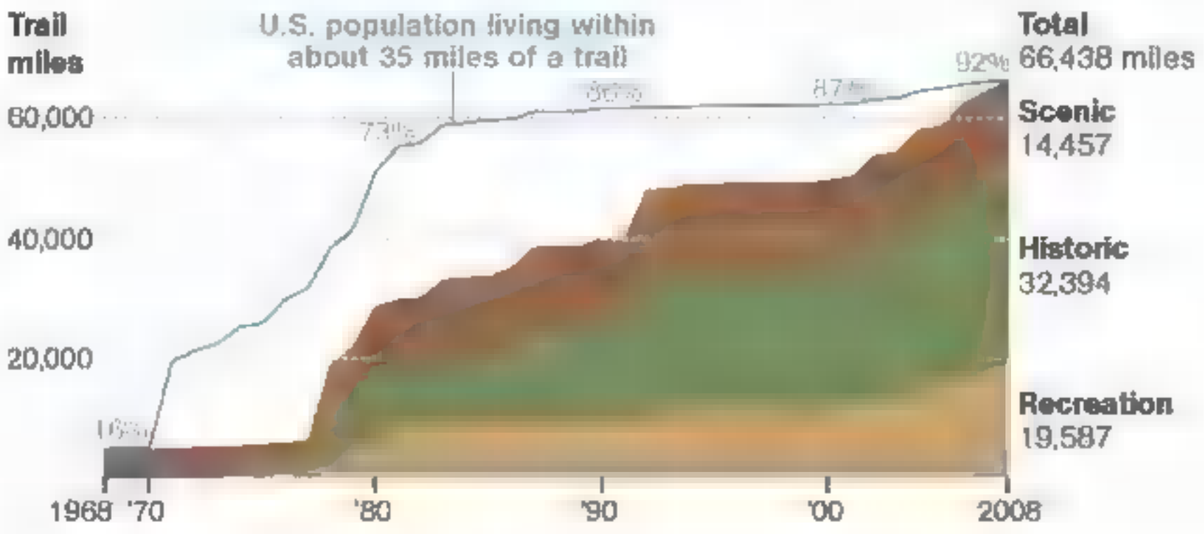
Through forest disease, disputes, and budget cuts, though, the essential values of the Ozarks remain. As forest along the trail matures, as ferns and saplings invade old logging roads, the land will look—on the ground, not just from mountaintops—more and more like that of the Osage, of Gerstäcker, of the settlers who tried to make a life in this rocky, up-and-down part of the world. As solitude and quiet become more precious, as mobile phones and Wi-Fi encroach, the trail and hundreds like it will endure to reward those who, at least now and then, prefer to trade skyscrapers for blue sky, iTunes for bird songs, and a seat at a sidewalk café for a sun-warmed rock alongside a mountain stream.

CELEBRATING 40 YEARS

A NATION OF TRAILS

A trail, at its most basic, simply connects two places. But Congress had something grander in mind in 1968 when it created the National Trails System, officially recognizing that trails can be more than routes to destinations. Ancient and new, they're living reminders of how our land was discovered and our culture built. Native Americans and, later, settlers wore the first trails into the landscape with moccasins, boots, and bare feet, hiking along rivers and coasts, through forests and over mountains, learning the flora and fauna as they went. Increasing numbers of Americans are following in their footsteps, finding pleasure and enlightenment along the way. Trail advocates—many of them volunteers who build and maintain trails—believe such experiences are worthy of national investment. Forty years ago, Congress agreed. □





More Trails, More People

A trail-building boom combined with rapid suburban growth have brought people and trails closer: Nine out of ten Americans live within 35 miles of a national trail.

Only Congress can authorize a national scenic trail or national historic trail, but any trail manager can nominate a national recreation trail for designation by the Department of the Interior or Department of Agriculture.

National Scenic Trails

The Appalachian and Pacific Crest Trails were the first of the eight NSTs named so far. Among the requirements: at least a hundred continuous, nonmotorized miles with outstanding recreation opportunities. No new NSTs have been named in 25 years, but Congress is considering trails in Arizona, New England, and the Pacific Northwest.

National Historic Trails

The 18 NHTs commemorate routes of historic or prehistoric importance, from ancient Hawaiian settlement to the 1965 voting rights march. The longest is the 5,665-mile California National Historic Trail. The newest is the Star-Spangled Banner Trail, established in June, which traces major events and venues of the War of 1812.

National Recreation Trails

Trails under 50 miles

Like a national seal of approval, designation as an NRT brings greater recognition—and eligibility for government grants—to these 1,051 trails, which promote fitness, conservation, and fun. Distributed across all 50 states, they're the fastest growing part of the trail system, with some 30 new routes added each year. Along with hiking and biking, some NRTs offer more adventurous fare, such as snowmobiling in the Nez Perce National Forest and caving in the Blue Ridge Mountains.

VIRGINIA W. MASON, NG STAFF; STEPHANIE L. GASPERS

SOURCES: AMERICAN TRAILS; FOREST SERVICE; NATIONAL PARK SERVICE; PARTNERSHIP FOR THE NATIONAL TRAILS SYSTEM

Amish man's miracle idea helps home heat bills hit rock bottom

Miracle heaters being given away free with orders for real Amish fireplace mantles to launch the invention that slashes heat bills, but Amish craftsmen under strain of early Christmas rush impose household limit of 2

Saves money: uses about the same energy as a coffee maker, so turn down your thermostat and never be cold again

By MARK WOODS
Universal Media Syndicate

(UMS) Everyone hates high heat bills. But we're all sick and tired of turning down the thermostat and then being cold.

Well now, the popular HEAT SURGE® miracle heaters are actually being given away free to the general public for the next seven days starting at precisely 8:00 a.m. today.

The only thing local readers have to do is call the National Distribution Hotline before the 7-day deadline with their order for the handmade Amish Fireplace Mantles. Everyone who does is instantly being awarded the miracle heaters absolutely free.

This is all happening to launch the HEAT SURGE Roll-n-Glow® Amish Fireplace that actually rolls from room to room so you can take the heat with you anywhere. That way, everyone who gets them first can immediately start saving on their heat bills.

For the first time ever, portable Amish fireplaces are being delivered directly to the doors of all those who beat the deadline.

These miracle fireplaces have what's being called the 'Fireless Flame' technology that gives you the peaceful flicker of a real fire but without any flames, fumes, smells, ashes or mess. Everyone is getting them because they require no chimney and no vent. You just plug them in.

The Fireless Flame looks so real it fools everybody but it has no real fire. So what's the catch? Well, the soft spoken Amish craftsmen who hand make the mantles are imposing a strict household limit of 2 to keep up with orders.

"We can barely keep up ever since we started giving heaters away free. With winter just around the corner, everyone's trying to get them. Amish craftsmen are working their fingers to the bone to be sure everyone gets their delivery in time for Christmas," confirms Timothy Milton, National Shipping Director.

"These portable Roll-n-Glow Fireplaces are the latest home decorating sensation. They actually give you a beautifully redecorated room while they quickly heat from wall to wall. It's the only way to dress up every room, stay really warm and slash your heat bills all at the same time," says Josette Holland, Home Makeover Expert to the rich and famous.

And here's the best part. Readers who beat the 7-day order deadline are getting their imported hi-tech miracle heaters free when encased in the Amish built real wood fireplace mantles. The mantles are being handmade in the USA right in the heart of Amish country where they are beautifully hand-rubbed, stained and varnished.

You just can't find custom made Amish mantles like this in the national chain stores. That makes the oak mantle a real steal for just two hundred ninety-eight dollars since the entire cost of the miracle heater is free.

This free giveaway is the best way to slash heating bills and stay warm this fall and winter. The HEAT SURGE Roll-n-Glow Fireplace gives you all the beauty and warmth of a built-in fireplace but it can also save you a ton of money on heating bills.

Even people in California and Florida are flocking to get them so they may never have to turn on their furnace all winter. And since it uses about the same energy as a coffee maker the potential savings are absolutely incredible.

"We are making sure no one gets left out, but you better hurry because entire communities of Amish craftsmen are straining to keep up with

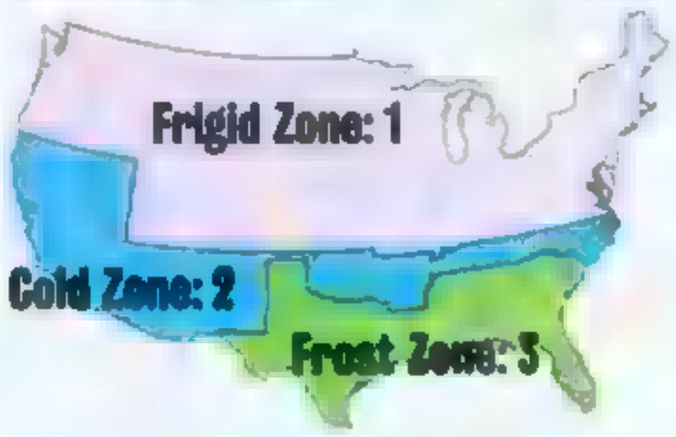
■ **GENUINE AMISH MANTLES MADE IN THE USA:** Everyone wants to save money on heat bills this winter, so entire Amish communities are working from the crack of dawn to finish. These fine real wood Amish made fireplace mantles are built to last forever. The oak mantle is a real steal at just two hundred ninety-eight dollars because all those who beat the order deadline by calling the National Hotline at 1-800-242-6155 to order the fireplace mantles are actually getting the imported hi-tech Fireless Flame HEAT SURGE miracle heaters for free.

How to get 2 free heaters

The National Toll Free Hotlines are now open. All those who beat the 7-day order deadline to cover the Amish made Fireplace Mantles and shipping get the HEAT SURGE miracle heaters free.

They have imposed a strict limit of 2 per household. Since some home woodworkers want to build their own mantle piece, they are letting people get the imported miracle heater alone for just $249. Or, with the Amish made mantle you get the miracle heater free.

Use the map below to locate the weather zone you live in and call the Hotline number for your zone.



Claim Code: FP4344

■ **ON THEIR WAY:** Early Christmas orders have turned country roads into pipelines to the big city delivery system. Everybody wants a fireplace that comes fully assembled with a handmade Amish mantle in oak or cherry and gets delivered by truck right to your door. All you do is plug it in.

EVERYONE LIVING IN THE **Frigid Zone: 1** START CALLING AT 8:00 A.M. TODAY	EVERYONE LIVING IN THE **Cold Zone: 2** START CALLING AT 8:30 A.M. TODAY	EVERYONE LIVING IN THE **Frost Zone: 3** START CALLING AT 9:00 A.M. TODAY
1-800-242-6155	**1-800-310-7731**	**1-800-625-7259**

©2008 HEAT SURGE #4239 0615508 1

HEAT SURGE® *Fireless* Flame

How It Works: The HEAT SURGE miracle heater is a work of engineering genius from the China coast so advanced, you simply plug it into any standard wall outlet. It uses about the same energy as it takes to run a coffee maker. Yet, it produces an amazing 5,119 BTU's. An on board Powerful hi-tech heat turbine silently forces hot air out into the room so you feel the bone soothing heat instantly. It even has certification of Underwriters Laboratories coveted UL listing. It also comes with a full year Money Back Guarantee.

demands. For now, we have to turn away dealers in order to let readers have two per household just as long as they call before the deadline," confirms Milton.

It's a really smart decision to get two right now because for only the next 7 days you get both miracle heaters free. That's like putting five hundred bucks right in your pocket and you can save even more money on your monthly heating bills.

"Everyone's calling to get one but those who are getting their Christmas shopping done early are surprising the whole family by getting two. So when lines are busy keep trying or log onto amishfireplaces.com. We promise to get to every call. Then we can have a delivery truck out to your door right away with your beautiful Amish made Roll-n-Glow Fireplace," Milton said.

"You'll instantly feel bone soothing heat in any room. You will never have to be cold again," he said. ■

On the worldwide web:
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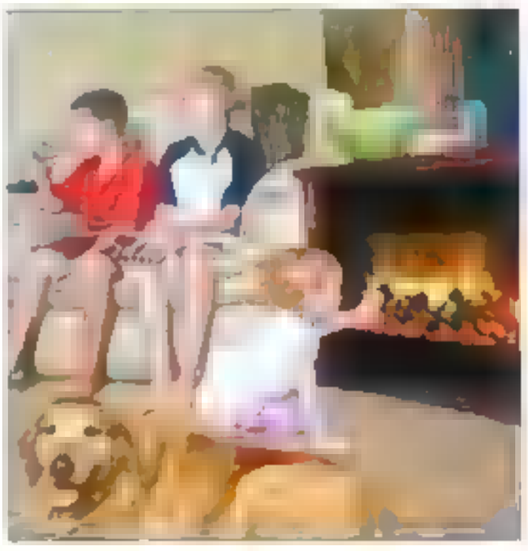
Rolls anywhere to throw an instant heat wave with no chimney, no vents, no wood and no smoke

■ **EASILY ROLLS ANYWHERE:** This is the portable Roll-n-Glow® Fireplace that easily rolls from bedroom to living room. No vents, no chimney and no tools. Just plug it in.

■ **SAVES ON BILLS:** Everyone gets low bills and stays warm and cozy. Naomi Abrams' new Roll-n-Glow Fireplace saves a ton of money and makes her front room look like a million bucks.



■ **SAFE:** The Fireless Flame looks so real it fools everybody but there is no real fire. That makes it safe to the touch. It's where the kids will play and the cat and dog will sleep.

■ **FREE:** Get this $249 miracle heater free. It is being given away free to all who beat the 7-day order deadline for your choice of the oak or cherry Amish Mantles. The free heater comes already encased.

Six-year-old James Carroll of Virginia helps clear a route on National Trails Day.

■ **Volunteer** Check with hiking clubs or environmental groups about opportunities to work on trails.

■ **Write Congress** Funding is tight for the growing system of trails. Remind elected officials that trails promote health and in many places offer "green" alternative commuter routes.

■ **Donate** Trail advocates advise giving to nonprofit "friends of the trail" groups that have adopted a trail.

OZARK HIGHLANDS TRAIL, PAGE 122

Path Minders

Without volunteers, many of America's trails would have disappeared long ago or never been built. In 2007 alone, trail lovers donated an estimated 676,960 hours of labor, worth about $13 million, to create and maintain national scenic and historic trails. Countless others have given time and money to build and sustain the thousand-odd national recreation trails. You don't have to go far to dig in. Wherever you live in the U.S., chances are a trail winds its way not far from your door. The 40-year-old National Trails System comprises over 66,000 miles, eclipsing the Interstate Highway System's 46,837 miles.

There's plenty of heavy lifting to do, and the American Hiking Society's Volunteer Vacations *(americanhiking.org)* links people of all abilities with projects nationwide. You can help clear fallen trees in the Ozarks, build a rock turnpike over a bog in Idaho's White Cloud Mountains, or cut new paths in California's fire-damaged Cuyamaca Rancho State Park. But trail advocates encourage new volunteers to start locally. Even picking up litter along ■ stretch of a favorite trail nearby helps keep the trail movement strong. *—Peter Gwin*

PHOTO: REBECCA HALE, NG STAFF

Touring a sprawling, hillside coffee plantation just outside Copan isn't the only reason you'll visit Honduras. But it's one of the many reasons you'll never forget.

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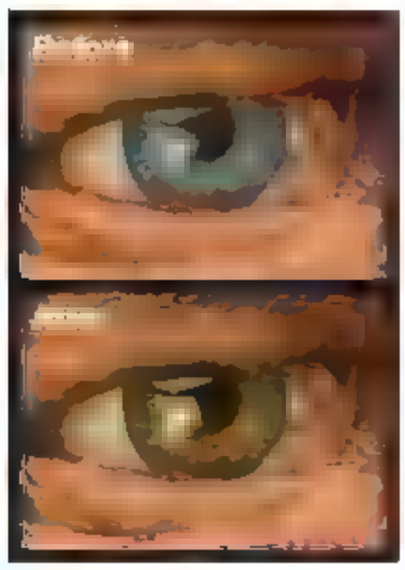
Dutch artists Adrie (at left) and Alfons Kennis created this figure of a Neanderthal woman.

To learn more about Neanderthals, watch *The Neanderthal Code* on the National Geographic Channel on September 21 at 9 p.m.

ON ASSIGNMENT **It Takes Two** Artists—and identical twins—Adrie and Alfons Kennis make a living painting and sculpting extinct life-forms. But they got their start, as children, drawing local creatures more recently expired: roadkill. "Our parents didn't like it when we came home with dead animals," Adrie admits. "As kids we learned to read skulls as you would a book. We still do that today."

The skull they used to model the Neanderthal woman for this issue's "Last of the Neanderthals" was not, of course, a 43,000-year-old original. These days, Adrie notes, "we can use casts from museums. We don't need the real thing." Although the real thing occasionally comes along. "Sometimes the zoo calls us and says, 'Do you want ■ dead chimpanzee?'"

Completing the Neanderthal took about six months, Adrie says. "When we work on projects like this, we want to make a character to recognize. Maybe you'll see her and say, 'That looks like Aunt Mary.'"



Why So Green?
Late-breaking news about early humans' appearance kept our Neanderthal story team hopping. Genetic studies released before the Kennis brothers started work on their figure indicated that the hominids likely had red hair, so blue seemed a reasonable choice for her eye color. Then after the figure's completion, a study by Hans Eiberg and colleagues at the University of Copenhagen indicated that blue eyes first showed up as a single mutation 6,000 to 10,000 years ago, at least 18,000 years after Neanderthals' extinction. The figure's blue eyes had to change. But what color should they be instead? Plain brown would be a safe pick, experts told us, but a greenish-brown color could also have occurred. So our Neanderthal woman's gaze was digitally changed—to hazel.

PHOTOS: JOE MCNALLY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INSIDE GEOGRAPHIC

Bendiksen visited a Jakarta garbage dump in 2007.

City View Jonas Bendiksen often trains his camera on slum dwellers going about their daily lives: an Indian girl walking along a pipeline that carries water through her neighborhood; an Indonesian man who lives under a bridge and sells discarded plastic. Now the 31-year-old Norwegian-American photographer is expanding his urban vision by turning his lens on the Chinese city of Chongqing. As the recipient of *National Geographic*'s $50,000 grant for photography, Bendiksen plans to live in the metropolis where half a million new residents arrive each year. China's government, he noted in his proposal, has designated Chongqing as ■ "hub for lifting western China out of backwardness into the 21st century." He will document those who are part of this experiment, from migrant laborers to the elite who live in Western-style developments with names like Beverly Hills.

Winning Big "The magazine continues to inspire and amaze," said the judges of this year's American Society of Magazine Editors' National Magazine Awards. They gave *National Geographic* three honors: for general excellence (the second year in ■ row), for photojournalism (John Stanmeyer's images for the July 2007 feature on malaria), and for reporting (Peter Hessler's June 2007 article on China's "instant" cities). "How does *National Geographic* do it?" the judges asked. Editor in Chief Chris Johns has the answer: "Talent, hard work, and dedication to excellence." The award itself (left), nicknamed the Ellie, is based on the Alexander Calder sculpture "Elephant."

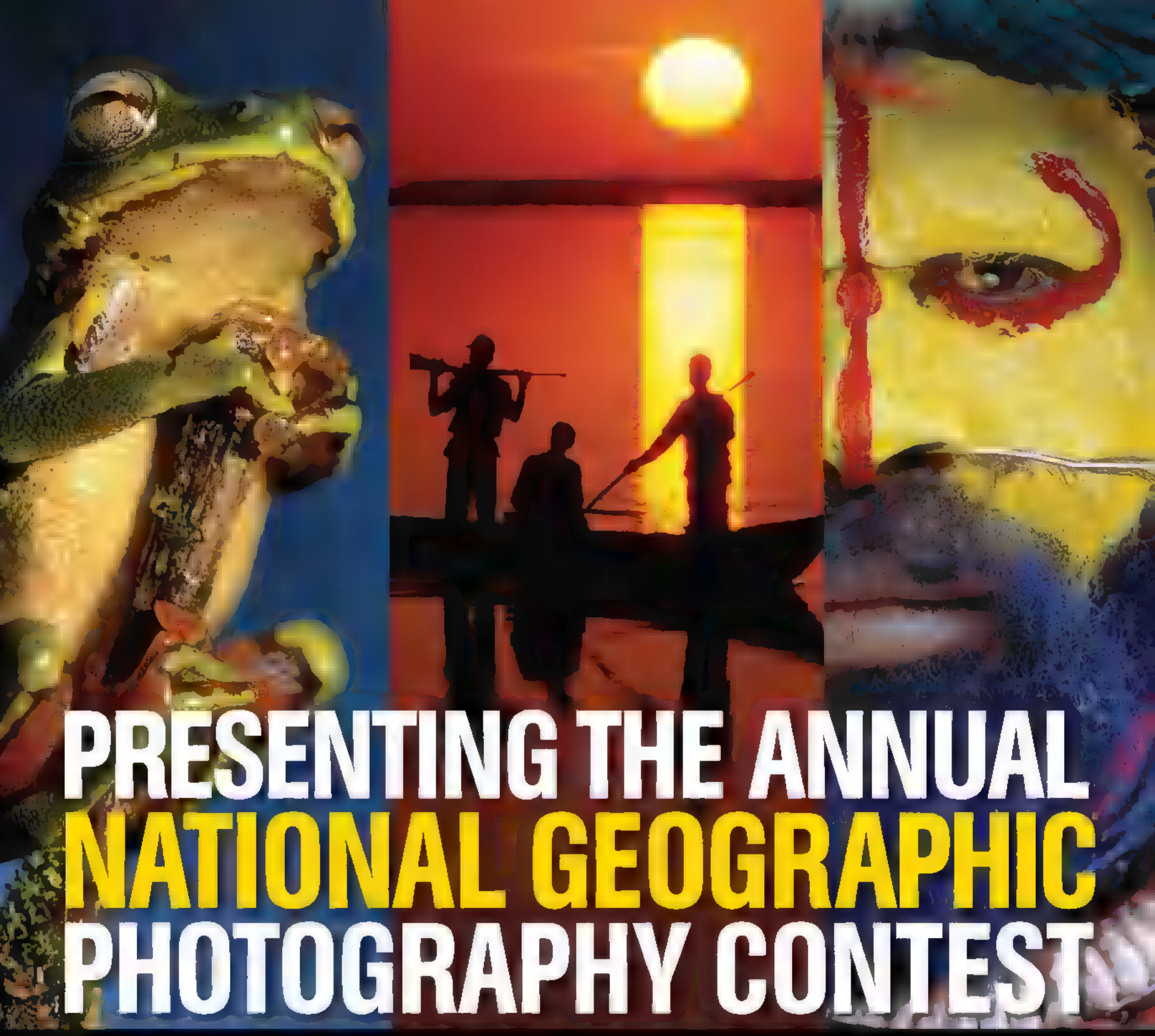
PEOPLE BEHIND THE STORIES

■ **Stephen S. Hall** Is the past really prologue? Hall, who wrote this issue's "Last of the Neanderthals," would say so—at least on the matter of meals.

Deep inside a fossil-rich cave in Spain one morning, he says, "a pungent odor assailed my nostrils. It was something those carnivorous Neanderthals would have recognized in a Middle Paleolithic minute: the smell of sizzling meat. University students [who helped with the excavation] were cooking bacon, frying bread, and guzzling espresso—a convivial repast unfolding just feet from one of the most productive Neanderthal sites in western Europe."

■ **Don Belt** A senior editor at the *Geographic*, Belt says one of the most important things he's learned on his far-flung assignments has to do with reportorial immersion. "Spend enough time in a place," he says, "and it's possible to see someone else's world from the inside out." It's a lesson he learned yet again while writing about India's "Fast Lane to the Future." After he rode several days with a trucker, stealing sleep when he could and eating in truck stops called *dhabas*, the "grubby, chaotic, dangerous world of the Indian highway" gave way to something that "made sense, had great value, and was essentially quite beautiful."

PHOTOS (CLOCKWISE FROM TOP LEFT): JONAS BENDIKSEN, MAGNUM PHOTOS; MICAELA HALL; REBECCA HALE, NG STAFF (BOTH)



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For more details, complete rules and regulations, and information on how you can enter today, visit *ngphotocontest.com*.

NATIONAL GEOGRAPHIC MAGAZINE

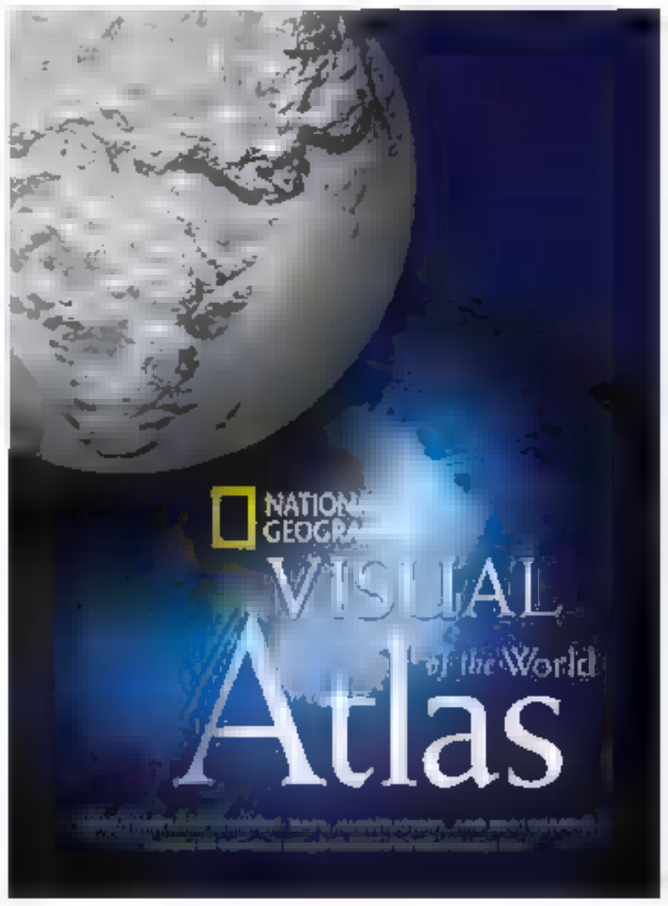
INSIDE GEOGRAPHIC

Stanford University biologist Robert Sapolsky studies baboons under stress at Masai Mara National Reserve in *Killer Stress*, airing September 24.

NG TELEVISION

Stressmakers

What do baboons in Kenya and British civil servants have in common? Both live according to rigid social hierarchies, enduring daily indignities from their groups' highest ranking individuals—and both suffer the effects on their health. *Killer Stress: A National Geographic Special* shows how (whatever kind of primate you are) unrelenting tension can result in conditions from belly fat to arterial blockage. Don't stress out, though: The show also offers suggestions for making life less stressful. *Killer Stress* airs September 24 on PBS. Check local listings for times.



NG BOOKS

Showing the World in Full

"We've never produced an atlas like this before," says Carl Mehler, project editor of National Geographic's just published *Visual Atlas of the World.* "This time we're using world-class photography to supplement—and celebrate—the atlas's freshly compiled regional cartography, so you can really see and get ■ feel for the places that the maps are showing you." In addition to regional maps, sections on climate change and its causes, the booming worldwide population, the growth of megacities, the availability of fresh water, as well as subjects from undersea topography to charts of outer space pack the book's 416 pages. Also featured is extensive cartographic and photographic coverage of the natural and cultural treasures that have been designated UNESCO World Heritage sites. National Geographic's new *Visual Atlas of the World* is available in bookstores now ($100).

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PHOTO: JOHN HEMINWAY, NATIONAL GEOGRAPHIC TELEVISION

Pat Minnick included National Geographic in her financial plans.

Give An Inspiring Gift

In 2007 Pat Minnick, a professional artist, decided to establish a charitable gift annuity to support National Geographic. She now receives a guaranteed life income and is a direct part of the Society's efforts to inspire people to care about the planet.

"I feel good knowing that National Geographic is doing so much to protect endangered wildlife," says Pat. "The environmental problems we face are vast, but by joining with National Geographic and their history of remarkable accomplishments, I know we can pass on a more beautiful world."

For more information about a charitable gift annuity or other ways to include National Geographic in your estate plans, please contact the Office of Gift Planning.

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FLASHBACK

Driving Faith "New York, Pennsylvania, New Jersey, and Maryland, with a combined population smaller than Poland…have more automobiles in service than the whole world outside of the United States," wrote William Joseph Showalter in his October 1923 *National Geographic* article, "The Automobile Industry." Pictured in that issue was one of those New York cars in service—to a higher power. The Reverend Branford Clarke's Brooklyn-based "traveling chapel" was equipped with stained-glass windows, an organ for his wife to play, and a fold-down steeple to help the whole thing fit in his garage. *—Margaret G. Zackowitz*

Flashback Archive Find all the photos at **ngm.com.**

PHOTO: UNDERWOOD AND UNDERWOOD/NG IMAGE COLLECTION

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Remember all the stupid things you did behind the wheel when you were a teenager?

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Whether texting, drinking or scrolling through songs, multitasking doubles the risk of having an accident.

Allstate believes there are ways we can help teens curb many of their dangerous driving behaviors:

BAN DIGITAL DISTRACTIONS.
Legislation banning some distractions can help discourage teen multitasking. The State of California has now banned anyone under the age of 18 from using cell phones, laptop computers, pagers or any text-messaging device while driving, except in the case of an emergency.

PUT LIMITS ON TEEN DRIVING.
Graduated Driver Licensing (GDL) laws restrict teen driving so kids can gain experience safely. Since North Carolina implemented one of the most comprehensive GDL laws in the country, it has seen a 25% decline in crashes involving 16-year-olds.

HAVE THE DRIVING TALK.
It may be surprising, but 75% of teens said their parents would be the best influence in getting them to drive more safely. The Allstate Parent-Teen Driving Contract can help start the conversation about many driving behaviors, including multitasking. **Contact an Allstate Agent to get a copy or visit Allstate.com/teen for the interactive contract.**

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Sources: The NHTSA 100 Car Driving Study, 2006, and The Allstate Foundation Report on Teen Driving, 2005